Heating and Ventilating

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

Volume 30 **MARCH, 1933** **Number 3**

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Published Monthly by

THE INDUSTRIAL PRESS, 140-148 LAFAYETTE STREET, NEW YORK

ROBERT B. LUCHARS, President — EDGAR A. BECKER, Vice-Pres. and Treasurer — ERIK OBERG, Secretary
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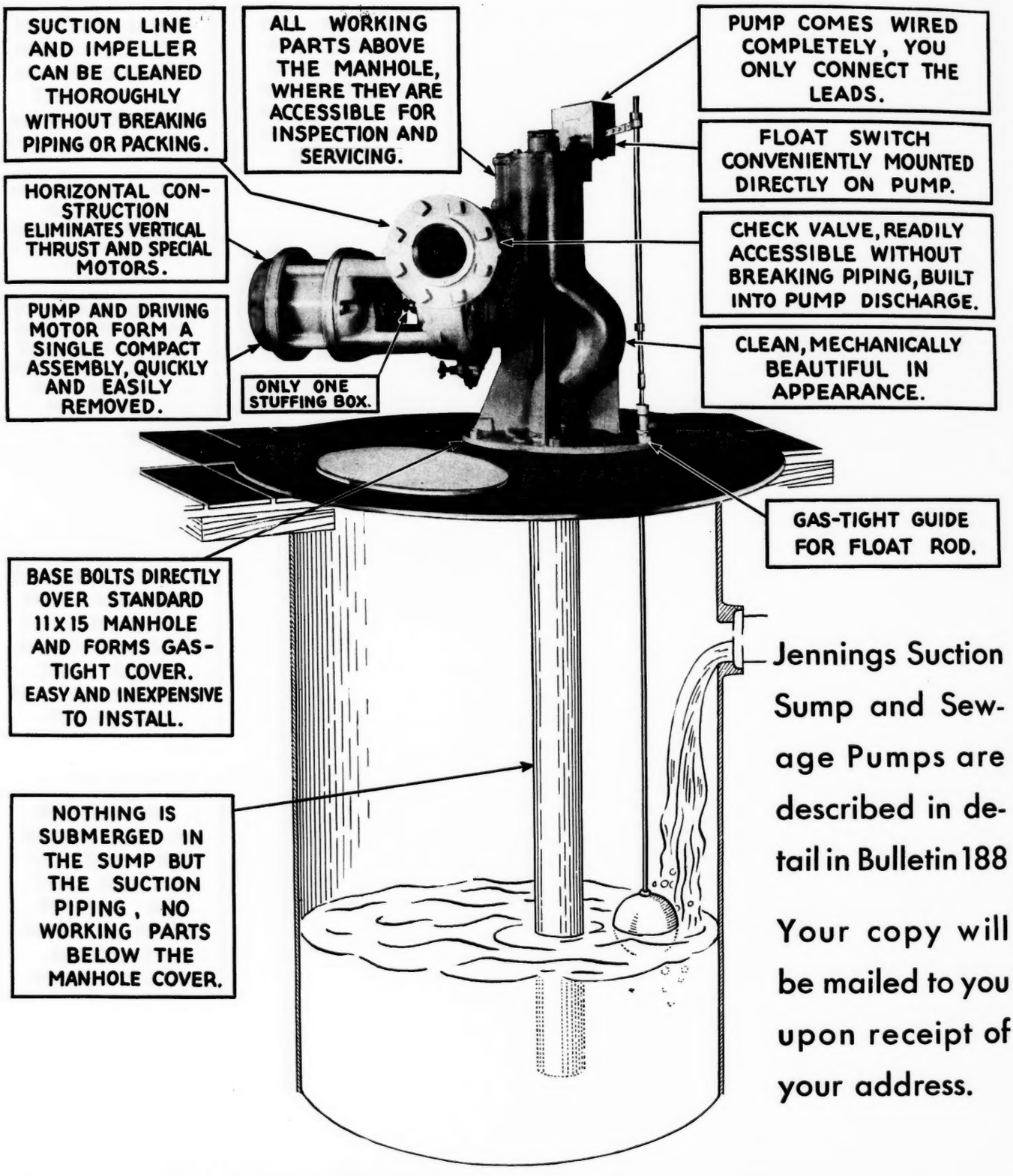
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Do You Use the Anemometer Correctly?

By FRED T. ELDER†

LIKE the thermometer, most of us use an anemometer more or less frequently and give little thought to it beyond realizing that it can be helpful in making damper adjustments and in checking up the amount of air flowing. As a matter of fact, this instrument is well worth attention, for, unless understood and properly handled, its usefulness may be greatly lessened or even lost entirely. Understanding of the instrument, its construction, its errors, and its correct handling on the job will not only give better results but will make its use possible with the discrimination which should be exercised, for the anemometer is not applicable to all cases of air flow.

By derivation and original development the anemometer is an instrument for measuring wind velocity and which has been adapted for measuring air velocities inside buildings. Although there are a number of forms of this meter we are concerned only with the ones which are commonly used in the heating and ventilating plants of buildings.

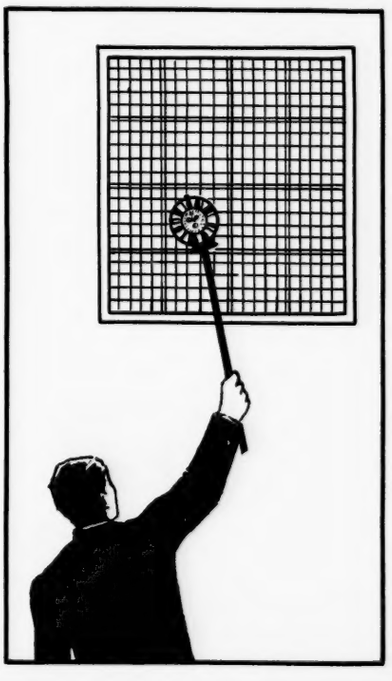
Construction

In this form the anemometer is an air-driven screw, set on fine bearings and so arranged that as it revolves a counting mechanism indicates on a dial the number of turns of the shaft. The propeller is surrounded by a substantial metal case and the counting indicator is mounted at the center. The dial of the counter can be, and usually is, graduated into feet instead of into revolutions of the shaft. The indicator is usually not solidly connected to the propeller but a clutch is provided by means of which it can be connected or disconnected at will by throwing a lever. This construction permits the propeller to run freely without having to furnish power to turn the indicator until after the propeller is running.

An important point in the construction is the design and accuracy of the bearings. These should be as nearly frictionless as possible if the instrument is for use at low air velocities such as are commonly found in ventilating and heating ducts. Ordinarily, lubrication cannot be depended on nor is it convenient or desirable to have to keep oiling an anemometer. The usual method is to try to build the bearings themselves as frictionless as possible. Any of the commercial anemometers are carefully built but the care and precision used will naturally be reflected to some extent in the price. Jeweled bearings are the type most often installed.

The commercial anemometer is available in two types—one for use where velocities are high and the other for low speed work. For general all-round ventilation work the low speed instrument with its vanes set at an angle less than 45° to the plane of the wheel is the one usually selected and is considered to have a range of use between 100 f.p.m. and 700 f.p.m. The vanes of the high velocity instrument are set at an angle greater than 45°.

Both a handle and a base are sometimes provided, but if only a base is attached, a handle can be easily rigged up and helps in manipulation.



Built-in Errors

In order to understand the instrument thoroughly it is necessary to note how it works.

If a stationary propeller with its blades set at an angle is placed in a stream of air some of the air particles bump into the face of the vanes. Being suddenly stopped they set up a pressure on the vane, and part of the energy tries to push the vane out of its position and start it to turning. If there is enough of this energy the vanes will start to turn. The greater the speed of the air stream, the greater the turning force on the vanes becomes, and the faster the wheel turns.

The first point to be noted about this arrangement is that some energy is necessary before the vanes actually start to move. This is the amount required to overcome the friction at the bearings. Thus, until the air stream moves fast enough to overcome the bearing friction the propeller will stand still and the instrument cannot be used. When the indicator is in gear the total friction is considerable. Just where the lower limit of use lies depends on the particular instrument, but 100 f.p.m. is often set as the useful lower limit.

A second fact to be understood is that since the anemometer is a velocity instrument it possesses the characteristic of all such instruments in that its dependability increases, as the ratio of energy transmitted to the energy required to overcome friction increases. At low air speed this ratio is small and the instrument is not dependable.

Another source of error, also present on account of the anemometer being a velocity instrument, is inertia of the moving parts. This is present if the velocity to which the vanes are exposed is not constant during the period for which a single continuous reading is made. This error tends to make the readings too high.

At high air speed centrifugal action causes the air particles to be deflected sideways when they strike the

†Assistant Editor, HEATING AND VENTILATING

vanes, and the pressure causes the vanes to distort slightly. The basic consideration behind the measurement of air movement in a turning vane is that the vane is truly screw-shaped, without thickness, and that the air flows in a straight line as it passes the propeller. If all these conditions are met a particle of air would move through a distance equal to the pitch of the screw every time the propeller turns around once. It can be seen that none of these conditions are exactly met in the commercial wheel. This is true at both high and low speeds but at high speed the displacement of the air and distortion of the vanes may become considerable.

Calibration

As a result of all these considerations it is evident that the very best built and highest priced anemometer neither can possibly be a strictly accurate instrument nor can it be relied upon to give a measurement without checking it against some known quantity. We take care of this difficulty by "calibrating" the instrument.

If the propeller wheel is allowed to turn in an air stream having a known velocity, and if the reading on the indicating device is taken, the variation between the known air speed and the speed shown by the anemometer can be noted. This plan makes it possible to overcome many of the constructional limitations of the anemometer so that its accuracy is perhaps not so bad as might be supposed on reading over the preceding paragraphs. Practically all commercial anemometers carry a calibrating table or curve which gives the correction to be applied to the indicator reading.

One other point regarding the calibrating table and its use is that any calibration applies only to the conditions under which the trial is run. In the case of anemometers the calibration is usually made by letting the propeller turn in an air stream having a temperature of about 70°. If the anemometer is being used at air temperatures other than about 70° an error is likely to be introduced. In other words, the calibrating table no longer applies. The reason for this is that with an increase in air temperature the bearings of the instrument expand and the friction of the instrument may be considerably above that at 70°. Again, the amount of this error will depend on the design of the bearings and the care with which the instrument is built. At very high air temperatures—especially if the anemometer is exposed to them for some time—the propeller may slow down very noticeably, or may even stop turning entirely. As most of our measurements in heating work are made at temperatures above 70°, this matter of the unreliability of the anemometer due to temperature change is important. What makes this temperature effect especially difficult in the practical use of the anemometer is that unless one knows his own instrument well, either from past experience or from having tried it out himself, there is no way to tell just how temperature will affect it.

Formulas

Probably the most common place for taking measurements by the use of the anemometer is in front of a metal grille or a register face. This is true whether the register is on a supply or exhaust line. Taking away the register and making measurements directly in the duct is usually neither possible nor desirable for removal of the register changes the resistance to air flow, and a reading taken without the register in place may be entirely misleading. Because the actual use of the instrument is thus confined so largely to such locations, a summary and rules for its use in front of registers will cover the use of the instrument anywhere.

When the system is of the pressure type, with air entering under pressure, and exhausted through ducts by gravity or by induced draft, readings should be made at the supply grilles, as there is no way of determining the volume of air that leaves through cracks and openings. For vacuum ventilation, in which case air is drawn out of the space through a duct, so that the air within the space is at a slightly lower pressure than that of the surrounding atmosphere, the measurements should be made at the exhaust grilles.

The latest studies made to learn the correct use of the anemometer in ventilating work are those of Prof. Lynn E. Davies, made at the Armour Institute, Chicago. He found that the following formula can be used.

$$\text{c.f.m.} = \frac{C\ V\ (A + a)}{2}$$

in which V = corrected average anemometer reading taken in contact with the grille, in f.p.m.

A = gross area of grille, in sq. ft.

a = net free area of grille, in sq. ft.

C = a coefficient, varying from 0.95 at 150 f.p.m. to 1.00 at 800 f.p.m.

With grilles of the decorative variety, it is often difficult, if not impossible, to estimate the amount of free area (a) with any degree of accuracy, and a small error in its determination will result in an important error in computing the flow. For this kind of grille, it is probable that the results obtained by holding the instrument several inches from the face of the grille, and multiplying the average corrected velocity so obtained by the gross area of the grille will provide an indication of the volume of flow most closely approaching the actual conditions.

The general procedure for determining the velocity through an exhaust register is identical with that described for the supply register, excepting that in all cases the instrument must be held in contact with the face of the grille, since the air is drawn into the openings from all sides as well as from directly in front. In exhaust register calculations, Professor Davies found that the value of the coefficient varies not only with the velocity, but also with the percentage of free area and the type of grille, and as a result the following formula is recommended:

$$\text{c.f.m.} = K\ V\ A$$

in which V and A are the same as in the preceding formula, and K is a coefficient whose value varies from 0.76 at 150 f.p.m. to 0.83 at 700 f.p.m.

If a constant value of 0.8 be used for K the maximum

error will be 7½%, while if the value of K is varied with the indicated velocity as noted, the maximum error should not exceed 4%.

Handling the Instrument

In spite of the findings of this recent investigation, care in using the anemometer is still of the very first importance for, no matter how accurately coefficients are known, the indications shown by the instrument will still govern the soundness of the final results. Careful handling will do much to insure the accuracy.

The first item in securing good readings at a register is to use a suitable method of traversing. There are two general methods.

The first of these is to divide the register face into a number of equal areas about 6 in. square, taking a reading with the instrument held at the center of each square for an equal period of time. The usual practice is to make this time period at each station not less than half a minute, with one minute preferred. Timing of these periods is of enough importance so that a stop watch should always be used. The instrument is held in place at the center of the square with the recording mechanism disengaged until the propeller has steadied its speed at each location. Then the engaging lever is tripped and the stop watch started. At the end of the period the counting mechanism lever should be thrown before the instrument is moved to the next position. Throwing the lever must be done carefully and at the exact time desired. An assistant to hold the watch and to call out "ready-go" and "ready-stop" is practically necessary on accurate work.

Careful use of this method of traversing will give readings which will approach the average velocity over the whole face of the register or grille, and this method, while longer and more tedious, is generally considered the better one for field use.

The other traversing method consists of moving the anemometer slowly over the whole face of the register at a uniform rate. The principal objection to this procedure is that the operator has to depend on his own sense of speed to judge whether he is really moving the instrument along steadily or not. There is a tendency both to hurry the work and to pass quickly over those parts of the grille where little air is flowing. The result is that the reading of the average speed will be shown greater than is really the case. On the other hand the stop watch need be started and stopped but once, and the trip lever for engaging and disengaging the counter need be thrown only at the beginning and end of the traverse. Success with this method is largely a personal matter.

In either method the reading shown by the instrument divided by the minutes of time elapsed when the counter is engaged, is taken as the average velocity of flow over the whole register face and is "V" for use in the formulas after applying the corrections shown by the calibration table or chart.

In actual use there are a number of precautions which help greatly in getting good readings. One is to rig the anemometer up to a long, stiff handle which will let it be placed in the air currents without upsetting conditions by the presence of your own body too close to the spot of observation. Such a handle also helps in reaching registers located too far off the floor. A second little refinement—and one easily made—is to use a string for tripping the counting mechanism. This permits starting and stopping without having to reach the lever by hand and thereby risking upsetting the flow condition or moving the instrument out of place. A third refinement is to mount the stop-watch on the handle with a lever which will trip the watch with the same motion which engages or disengages the counter.

In spite of its limitations and the care with which it must be used in the field, the anemometer is still the best all-round measuring instrument for air flow which is generally available. No other measuring device approaches it in portability, simplicity, and lightness. Neither is there any other which does not require a more extended theoretical understanding. Instead of concluding that the instrument is not reliable it is much better to master the few tricks of manipulation and use it properly.

Analysis of Industrial Dusts to Determine Their Degree of Harmfulness

PROPERTIES of a given dust which determine its capacity to produce pulmonary injury are its chemical and mineralogical composition, its particle size, and the quantity in which it is present in the atmosphere, according to J. J. Bloomfield, sanitary engineer, United States Public Health Service.

Research on the problem of industrial dust has established the fact that in general those dusts that are high in quartz content most readily produce a disabling fibrosis of the lungs. Industrial dusts may be classified into three groups with regard to their fibrosis-producing qualities: those composed completely of combined silica, such as pure asbestos; those containing free silica in the crystalline form, such as quartz; and dusts containing free silica in a non-crystalline form. It has been found that the harmfulness of a quartz-containing dust is in direct proportion to its quartz content. A combined chemical and petrographic analysis is employed to accurately determine the mineralogical characteristics of a dust.

So far as the size of the dust particles is concerned, it is apparent that the material must gain access to the terminal portions of the respiratory tract where the harmful effects take place, and it is known that not all of the particles of inhaled dust gain access to or are retained by the human lung. It has been demonstrated that particles of a size greater than 10 to 12 microns in longest dimension are rarely found in lungs. From all evidence at hand, it is apparent that for practical purposes we need only be concerned with those dust particles between one micron and five microns in longest dimension.

Robinson & Campau, Architects *Burritt A. Parks, Consulting Engineer* *Smith, Hinchman & Grylls, Associate Engineers*

Air Conditioning a Civic Auditorium

By BURRITT A. PARKS†

The heating, ventilating and conditioning of the new million dollar exhibition hall and community center in Grand Rapids. Calculations of air conditioning load.

IN 1930 the City of Grand Rapids approved a bond issue of $1,500,000 for the erection of a Civic Auditorium and Convention Hall. Plans were developed and construction started in the spring of 1932. The structure was opened and dedicated January 1, 1933.

Construction of the building was undertaken for a twofold purpose—to provide employment and to supply Grand Rapids with needed facilities for accommodating exhibitions, conventions, concerts, indoor athletic events, and various forms of public assemblage.

The building, exclusive of site and furnishings will cost just about $1,000,000. On account of very favorable conditions as to construction costs the City thus obtains an unusually complete building for the money—a building which would cost at least 25% more in normal times.

In order that the building may be as flexible as possible and adaptable to a large variety of uses the structure has been divided into three major units—the Main Auditorium, the Small Auditorium or Assembly Hall, and the Exhibition Hall. Each of these units may be in use without disturbance to the other two or all may be interconnected and used together.

The building is heated by steam supplied by the local utility company, being delivered to the building at about 15 lb. pressure. It is reduced to 4 or 5 lb. for supplying the direct radiation and 8 to 10 lb. for the air conditioning units.

There are three separate heating mains—two running in opposite directions around the basement for supplying the direct radiation and one leading to the attic to supply the air conditioning units. The return lines parallel, in general, the two basement steam mains connecting to two duplex vacuum pumps—one in the northwest and one in the northeast corner of the building. The two sets of vacuum pumps are necessary because of the impossibility of bringing a return main across the rear of the building. On account of the proximity of Grand River and the fact that high water level is considerably above the ground floor or basement level, the

†Consulting engineer, Grand Rapids.

basement floor slab is heavily reinforced to resist upward water pressure and no trenches in the floor could be allowed.

All corridors, lobbies, offices, dressing rooms, toilet rooms, committee rooms, storage rooms, etc., are heated by means of direct radiation. The entrance vestibules are normally heated by means of direct fin type radiation enclosed in recesses and so connected by duct work and a supply fan on the basement ceiling that a positive and heated air supply may be introduced into the vestibules, placing them under a partial plenum and helping to counteract cold drafts from outside when large crowds are passing through.

The main lobby is somewhat similarly treated, being normally heated by means of direct radiation but when large crowds are passing in or out of the entrances warmed air is blown out through grilles above the doors leading to the auditoriums and directed toward the outside entrances. This warmed air is supplied by independent fan-heater units located under the balcony of the main auditorium and taking air through grilles at the floor line from the lobby.

The main auditorium, the small auditorium or assembly hall, and the exhibition hall are entirely heated by indirect means, except that there is a small amount of direct radiation located in recesses below the windows along the west wall of the assembly hall to help kill cold drafts. The above spaces are heated and ventilated by means of conditioned air which is filtered, warmed and humidified in the winter and filtered, cooled, and partially dehumidified in the summer.

Considerable study and investigation was made as to the type of air conditioning apparatus to use, as it was desired to provide as complete a job of air conditioning as the nature and use of the building would justify without going to extremes in cost. Fortunately, there is available at a depth of about 250 feet, an ample supply of water at a temperature of about 50 degrees. A preliminary estimate of the refrigerating equipment necessary to give a fair degree of cooling in the summer time indicated that an expenditure of about $30,000 would be required for the refrigerating machinery alone. As the building undoubtedly will not be in use every day, and probably will not be a self-supporting venture at best, it was decided that the last refinement in air conditioning equipment was not justified, and that such cooling as was thought desirable would have to be obtained through proper use of the cold ground water.

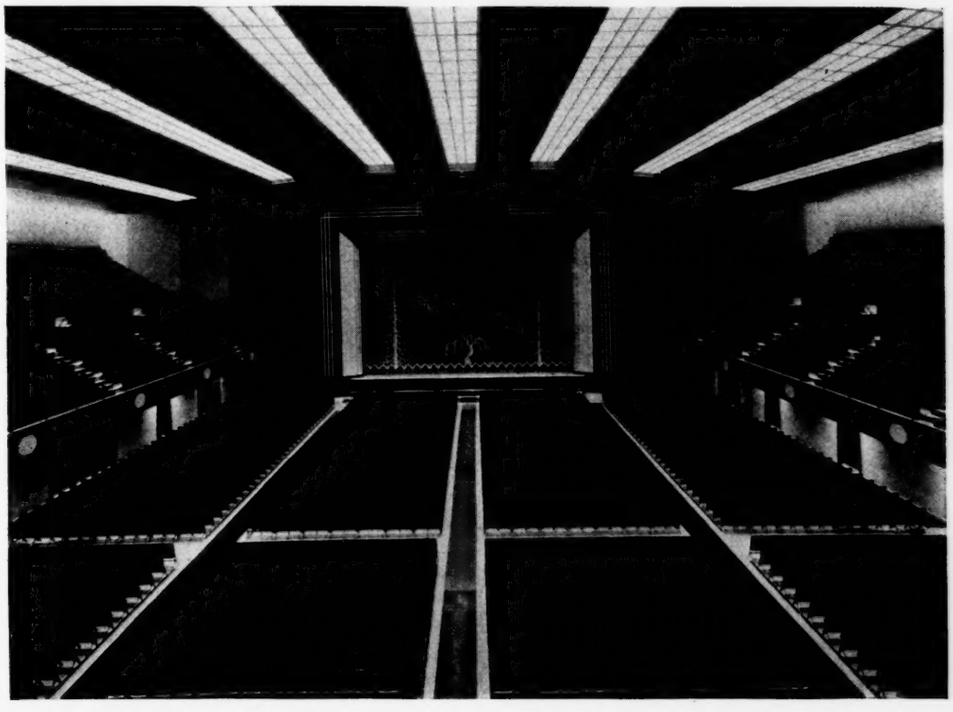
Investigation also convinced the writer that where the cooling water temperature is 50° or above, an air washer type of cooler is not justified on account of the danger of increasing the relative humidity with a decreasing temperature. It was therefore decided to keep the cooling medium out of contact with the air to be cooled by using copper extended surface.

Specifications were prepared asking for performance guarantees under the following conditions:

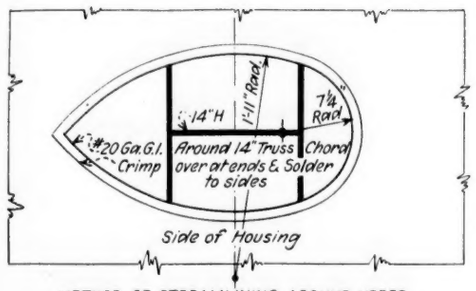
"As a refrigerating medium for use in the air conditioning units for cooling and dehumidifying, well water will be available at a temperature of about 53° at the unit. For units No. 1 to 6, incl., there will be supplied 175 g.p.m. and for unit No. 7, 125 g.p.m.

"Assuming that the building will be reasonably tight to prevent entrance of outside air; that all doors and windows, except public entrances, will be closed; and that the maximum number of people and electric lighting load will be as given below. Contractor is to name the minimum dry bulb temperature and percentage of humidity obtainable with outdoor dry bulb temperature at 95° and wet bulb temperature of 75°, and assuming 80% recirculation."

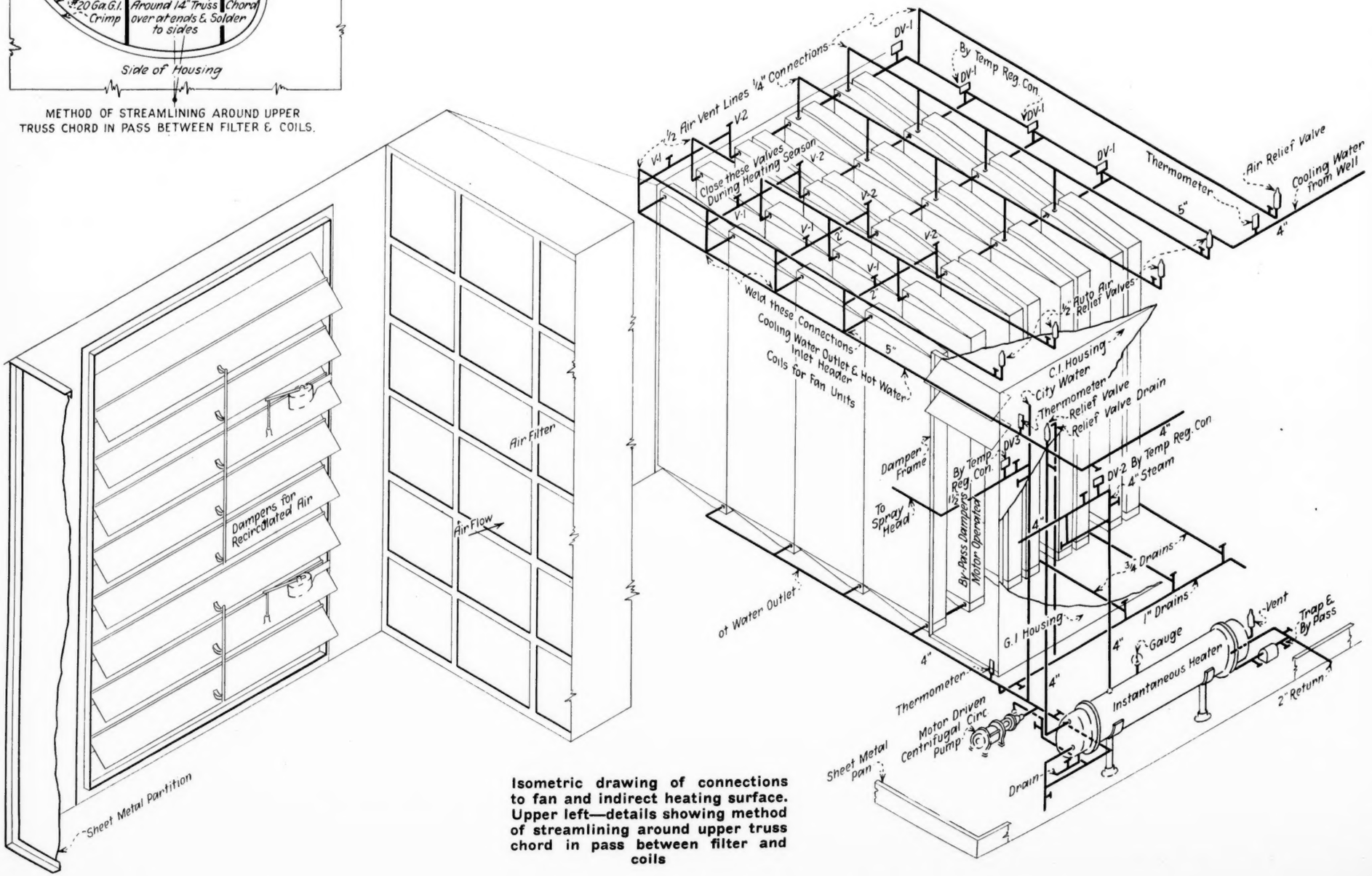
	People	Lighting Load-Kw.
Auditorium	5000	100
Assembly hall	800	15
Exhibition hall	1000	40



Main auditorium—Air discharged through 48 slotted openings in ceiling and vented through grilles under balcony overhang and through mushroom vents in upper part of balcony to space below balcony and thence to attic



METHOD OF STREAMLINING AROUND UPPER TRUSS CHORD IN PASS BETWEEN FILTER & COILS.



Isometric drawing of connections to fan and indirect heating surface. Upper left—details showing method of streamlining around upper truss chord in pass between filter and coils

In addition, the amount of air to be handled by each unit was specified and the face velocity through the coils was limited to a maximum of 625 feet per minute.

Air Conditioning Units

For heating and ventilating the above mentioned rooms, units of the following capacities were selected.

Auditorium—4 units, 30,000 c.f.m. each.

Exhibition hall—2 units, 30,000 c.f.m. each.

Assembly hall—1 unit, 22,000 c.f.m.

Each air conditioning unit consists of an air filter of the replaceable dry cell type; a bank of humidifying sprays; combination heating and cooling coils 8 sections deep, 3 pipes per section, of the extended surface copper tube type; a bank of eliminators, and a fan.

Coils are of special design consisting of ½ in. O.D. copper tubes 1 in. on center across the face of the coil and 1¼ in. on center in direction of air flow, with copper fin extended surface. The sections are so connected and valved that they are all in use in the summer for cooling and dehumidifying, and for heating service two sections are used, the remaining six sections being valved off and drained.

Cooling water from the well is admitted to the top of the last or eighth section of coils (toward the fan), down and into the bottom of the seventh section, up and into the top of the sixth section, and so on to the first section where the water passes out at the top to waste.

For heating purposes an instantaneous type heater and motor driven circulating pump is provided for each unit. Steam supply to the heater is controlled by the temperature control system to vary the water temperature in accordance with the heat demand. This gives very close control of the air temperature leaving the fan and considerably simplifies the temperature control equipment.

A by-pass is provided at the side of the coils with air motor operated damper for by-passing a portion of the air around the coils, thus making the apparatus more responsive in the event of rapid changes in heat demand. This by-pass is also used in summer to give more responsive control of cooling and dehumidifying.

Coils, instantaneous heater, and circulating pump are all mounted in a heavy drain pan so that any leakage will be discharged to waste without injury to the building. The fan, fan motor, and direct connected motor driven circulating pump are mounted on sound insulative bases to absorb vibration. Canvas connections are made to the fan in the usual manner and the first twenty feet of the discharge duct is lined with a special acoustical felt to absorb or dissipate the air noises incident to operation of the fan.

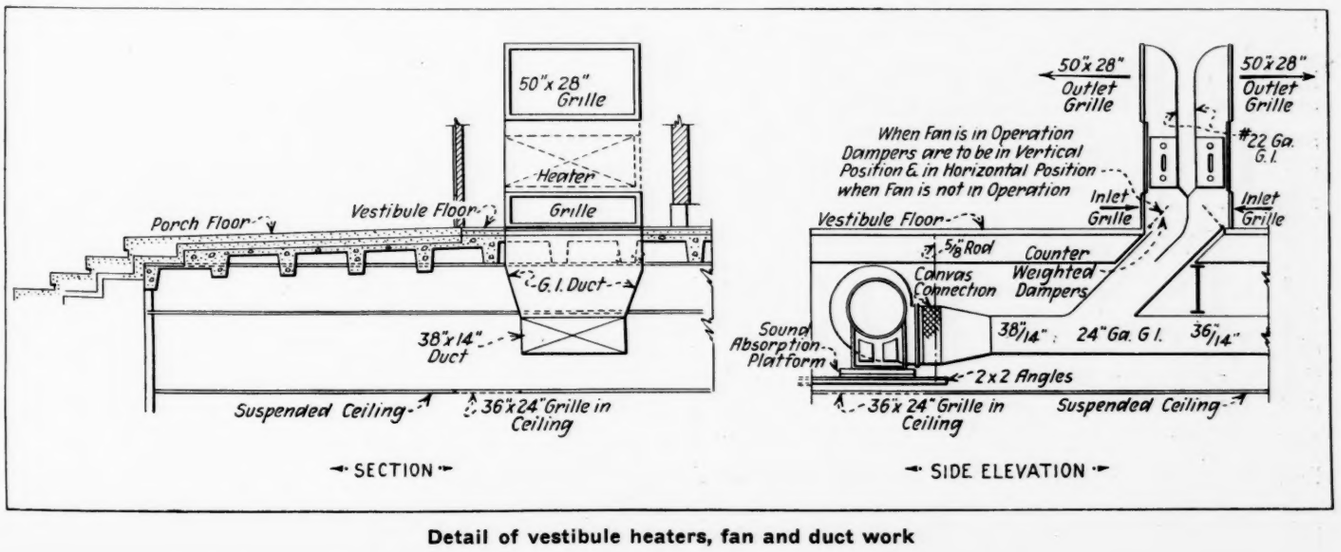
All motors for driving the air conditioning unit fans are of the slip ring variable speed type especially selected for quiet operation.

With the above described air conditioning units the following results are expected when used for cooling and dehumidifying, when supplied with the amount of cooling water previously mentioned, and when recirculating 80%.

Outside air conditions—dry bulb temperature 95°
wet bulb temperature 75°
dew point 66°
relative humidity 39%

Inside air conditions—dry bulb temperature 80°
wet bulb temperature 68°
dew point 62°
relative humidity 55%

The four units for ventilating the main auditorium are located in the attic space above—two units on each side. Each unit discharges through a system of duct work to openings in the ceiling, as indicated on the plans. These openings have no grilles and direct the air downward at an angle toward the center—the velocity being adjusted so as to bring the air to the breathing line and create a moderate turbulent effect near the floor. The air is vented through grilled openings in the balcony overhang and also through 360 8-in. mushroom vents in the upper part of the balcony to the space below the balcony and thence to the attic through a furred space running around three sides of the room. The attic space therefore serves as a return air chamber from which air is drawn through the recirculated air inlets to the conditioning units. A monitor is provided on the roof with air motor controlled louvers



Detail of vestibule heaters, fan and duct work

View in attic space over main auditorium showing ductwork and arrangement of lighting

so that all or any part of the return air may be vented.

The two exhibition hall units are located in fan rooms on either side of the stage, discharging down through flues to large furred-in ducts on the exhibition hall ceiling. Air escapes from the ducts through louvered openings worked in in connection with the lighting fixtures. Ventilation of this room is across the room in both directions to combination vent and pipe galleries running along the east and west sides of the room. On account of the long horizontal runs the air is exhausted by means of a fan from each vent gallery and discharged back to the fan rooms where it may be recirculated or vented to the atmosphere as conditions dictate.

The air conditioning unit for ventilating the assembly hall is located in a fan room above the assembly hall stage and discharges by means of duct work in the attic through ornamental plaster grilles in the ceiling. Air is vented from the room through grilled openings below the stage and thence up a flue to the fan room where it may be vented to the atmosphere or recirculated as for the other air conditioned rooms.

All toilet rooms, coat rooms, or other portions of the building where objectionable odors may develop are provided with mechanical exhaust ventilation. There are a total of 18 supply and exhaust fans throughout the building providing adequate ventilation whenever required.

Temperature Control System

A complete system of pneumatic temperature control is installed applied to all air conditioning units and direct radiation. The portion of the system controlling the direct radiation is of the dual type with the building divided into five zones. Any or all zones may be placed on "high" or "low" temperature by manipulating the proper switches at the control panel in the machinery room. This allows of any portion of the building comprising one of the zones—such as the assembly hall with its lobby, corridors, dressing rooms, etc., being brought up to and maintained at, say 70°, while the remainder of the building is maintained at, say 50°. This arrangement will undoubtedly result in considerable saving in steam consumption over the usual installation.

Control of the air conditioning units for winter operation is through room thermostats actuating a graduated acting valve in the steam line to each hot water heater supplying hot water to the coils. There is also an adjustable insertion type thermostat in each fan discharge operating in such a manner that the temperature of the air discharged to the room will gradually change between a maximum and minimum air temperature, depending on the heat requirement of the room. This insertion thermostat also actuates the by-pass damper around the coils so as to effect quick response to changes in heat demand.

Two adjustable hygrostats are also located in each room arranged to control the humidifying sprays and thus regulate the humidity.

Summer regulation is accomplished by means of differential thermostats—one exposed to the outside and the other to the inside temperature. These thermostats operate in such a manner as to maintain a predetermined constant differential in dry bulb temperatures between inside and outside. This differential is adjustable to give a maximum of 15° with an outside temperature of 95° and, of course, will be reduced with drop in outside temperature. These differential thermostats operate the by-pass damper to the coils to maintain the desired dry bulb temperature, while the hygrostat controls the cooling water supply to the coils to give the desired wet bulb temperature within the capacity of the apparatus. The insertion graduated acting thermostat in each fan discharge also operates in the summer time to effect gradual change in dry bulb temperature between a predetermined maximum and minimum.

Temperature Indicating System

In order that convenient and accurate control of the air conditioning units may be accomplished, an electrical temperature and humidity indicating system is installed. This installation indicates on a panel in the machinery room the wet and dry bulb temperatures existing in various parts of the ventilated rooms. With this information the operator is enabled to make such adjustments as are necessary to secure the optimum conditions for comfort.

Costs

The cost of mechanical and electrical equipment was approximately as follows:

Heating, including automatic sprinklers	$32,000
Ventilation and sheet metal work, including fans, motors, air conditioning units	66,150
Electric wiring, including all lighting equipment (except purely decorative fixtures) temperature indicating system, intercommunicating telephone system, clock system	110,300
Plumbing	28,300

Cooling Calculations—Main Auditorium

Seating capacity 5000
Cubic contents ..... 1,060,000 cu. ft.
Fan capacity, assumed ..... 4 @ 30,000 c.f.m., or 120,000 c.f.m. total

EXTREME SUMMER CONDITIONS

	Inside	*Outside*
Dry bulb	80°	95°
Wet bulb	68°	75°
Dew point	62°	66°
Rel. hum.	55%	39%

1—*Heat Gain* — *B.t.u. per hr.*

Body heat (sensible) 5000 × 240 is 1,200,000
Lighting—100 kw. × 50% × 3.415 × 1000 170,750
(Assuming 50% of connected lighting load as average).
Walls—8500 (sq. ft.) × 0.34 × 10 (t_1—t) is 28,500
Roof—31,500 (sq. ft.) × 0.4 × 20 (t_1—t) is 252,000
Total sensible heat gain per hour 1,647,250
Total sensible heat gain per minute 27,500

120,000 c.f.m. under given conditions is approximately 10,000 lb. per min.

$\frac{27,500}{10,000} = 2.75$ B.t.u. per lb. of air to be absorbed by air and removed from room.

$\frac{2.75}{0.24 \text{ (sp. ht. of air)}} = 11.5°$ difference between room temperature and that of entering air.

Inside room temperature assumed at 80°, therefore temperature of entering air should be 68.5°.

2—*Moisture to be absorbed*

At 80° one person will give off approximately 1100 grains of moisture per hr.

5000 × 1100 is 5,500,000 grains per hr., or 91,500 grains per minute.

$\frac{91,500}{10,000}$ is 9.15 grains of moisture added per lb. of air by people.

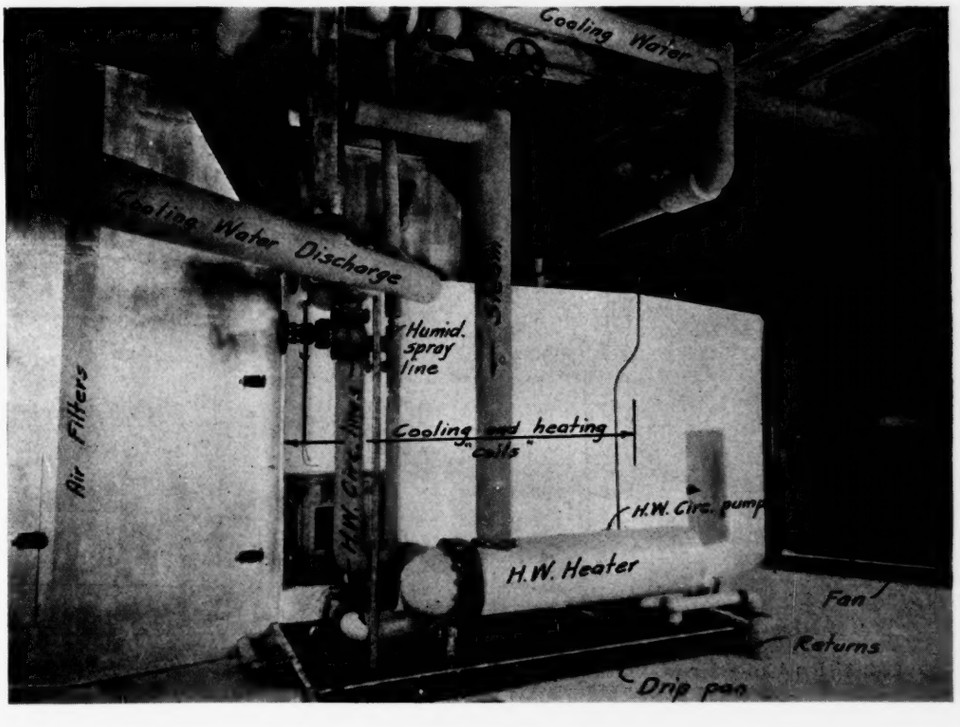
3—*Heat to be absorbed by cooling coils*

	B.t.u. per hr.
Sensible heat (see above)	1,647,250
Latent heat — $\frac{5,500,000}{7000} \times 1040 =$	817,500
	2,464,750

(1040 B.t.u. is latent heat of moisture at body temperature)

Outside air at the assumed conditions contains 6.78 grains of moisture per cu. ft. and at the inside conditions 6.26 grains per cu. ft. From any fresh air used there must then be removed 0.52 grains per cu. ft. With 20% fresh air the B.t.u. to be absorbed in dehumidifying would be

$\frac{120,000 \times 0.20 \times 60 \times .52 \times 1000 \text{ (latent heat)}}{7000} = 107,000$



Typical air conditioning unit

To cool the fresh air from 95° D.B. to 68.5 D.B. (air temperature leaving air conditioning unit) heat to be absorbed equals

$$\frac{120{,}000 \times 0.20 \times 60 \times (95 - 68.5)}{55} \text{ or } 690{,}000$$

The total is then 2,464,750 + 107,000 + 690,000 = 3,261,750 B.t.u. per hr. or 54,500 B.t.u.'s per min.

With cooling water assumed as entering the cooling coils at 53° and allowing a 10° rise in temperature in passing through the coils, the cooling water required is $\frac{54{,}500}{10 \times 8.3} = 660$ g.p.m. (approx.)

(Note that the plans call for four air conditioning units for the main auditorium and that specifications stipulate 175 g.p.m. for each unit.)

4—*Condition of mixed air before entering cooling units*

Assume 80% of air recirculated, 20% outside air.

80% recirculated air at 62° D.P. contains about 83 gr. moisture per lb. or in 1 lb. of mixed air	67.5 gr.
20% fresh air at 66° D.P. contains 96 grains moisture per lb. or in 1 lb. of mixed air	19.2 gr.
Total moisture in 1 lb. of mixed air	86.7 gr.

Air carrying 86.7 gr. of moisture per lb. has a D.P. of about 63°.

Total heat per lb. of the recirculated air (68° W.B.) is 31.75 B.t.u. or in 1 lb. of mixed air 31.75 × 0.80 is	25.3
Total heat per lb. of fresh air (75° W.B.) is 37.75 B.t.u., or in 1 lb. of mixed air 37.75 × .20 is	7.5
B.t.u. per lb. of mixed air	32.8

A total heat of 32.8 B.t.u. corresponds to a wet bulb temperature of 69°

A D.P. temperature of 62° corresponds to a D.B. temperature of about 83°, which, therefore, is the condition of the mixed air entering the cooling coils and by-pass.

5—*Condition of air at fan inlet or mixture of by-passed and cooled air*

Air in room at 80° D.B., 68° W.B. and 62° D.P. contains about 83 gr. of moisture per lb.

9.15 gr. per lb. of air is given off by people—therefore air entering room should not contain over about 74 gr. per lb.

D.B. temperature of air entering room was estimated at 68.5°. Allowing 2.5° rise in temperature in fan and duct work the mixed air leaving cooling coils and by-pass should not exceed 66° D.B. Air carrying 74 gr. of moisture per lb. has a D.P. of about 58.5° and the corresponding W.B. temperature is 61.5°. The total heat of 1 lb. of air under these conditions is about 27 B.t.u.

Air entering the cooling coils and by-pass was found to have a total heat of 32.8 B.t.u. per lb. Therefore the cooling coils must remove 32.8—27 or 5.8 B.t.u. per lb. of air. With approximately 10,000 lb. of air supplied per minute the total heat to be removed will be 58,000 B.t.u. per min.

6—*Moisture to be removed by cooling coils*

Under paragraph 3 the moisture to be removed from the fresh air was found to be 0.52 gr. per cu. ft.

120,000 × 0.20 × .52 is	12,500 gr. per min.
Moisture given off by people (paragraph 2)	91,500 gr. per min.
Total	104,000 gr. per min.

Calculations may be given another check as follows: Condition of air entering cooler (62° D.P.) air will contain about 84 grains of moisture per lb.

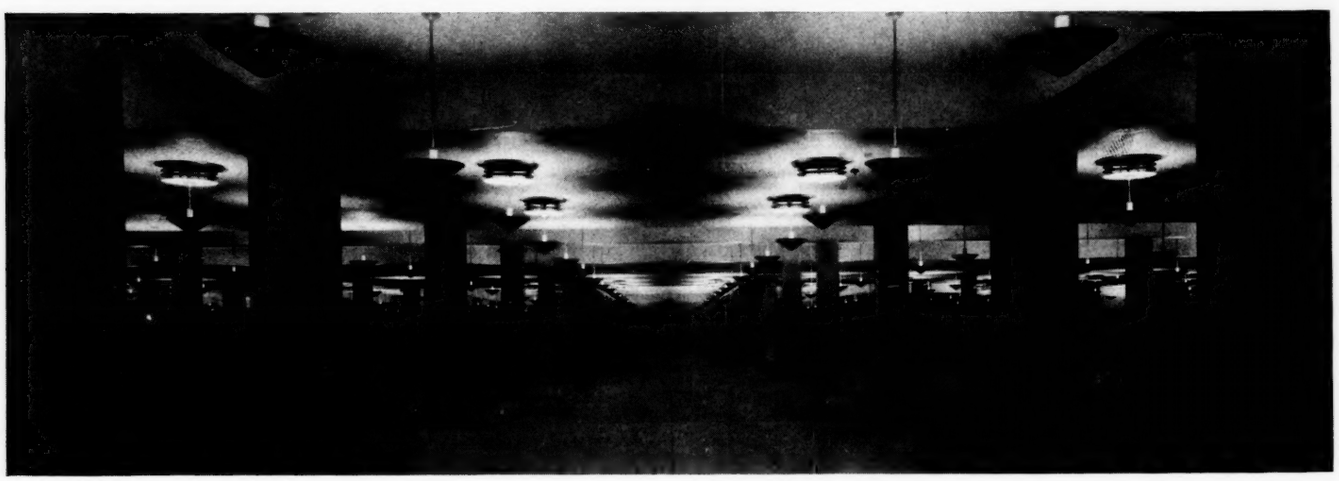
Condition of air leaving cooler (58.5° D.P.) air will contain 74 grains of moisture per lb.

Amount of air being supplied, 10,000 lb. per min. 10,000 × (84 — 74) is 100,000 grains of moisture per min.

7—*Cooling Coils*

Cooling coils should, therefore, be designed to reduce the dry bulb temperature from 83° to 66°; to absorb and remove from the air about 55,000 B.t.u. per min., and to condense and remove from the air about 100,000 grains, or 14.3 lb. of moisture per minute.

Recommendation as to cooling surface, number of coils deep, number of passes of cooling water, etc., is, of course, a problem for the manufacturer who presumably has conducted the requisite tests on which to base his performance guarantees.



Exhibition hall—Air discharged through diffusing outlets in furred-in duct on ceiling. Air vented through registers (seen in distance) to vent galleries on each side of room

Testing the Skill of the Welder

If you are learning to weld, or if you are training men to be welders, Mr. Lunn's suggestions will be of value. The material is abstracted from a paper "Pre-Qualification Tests for Welders," presented by the author before the American Welding Society meeting in Buffalo, October 5, 1932.

By ERNEST LUNN†

A PERTINENT question usually asked by a prospective welder is, "How long will it take me to weld and what qualifications must I have before I can be rated as a first-class welder?" A good answer is, "Only so long as it takes you to acquire the habit of subconsciously manipulating the welding appliances (the acetylene torch and the electrode) in a manner to produce welds having certain characteristics which experience has shown are required in welds free from objectionable faults."

The most trying time in a man's welding career is during the period when he is endeavoring to train his muscles to act in ways to which they are not accustomed, and to force them to perform at once, as they ordinarily do after weeks and months of patient effort.

The apparent simplicity of the various welding processes is likely to lead to erroneous conclusions on the part of the uninitiated operator. Directing undeveloped muscular action by will power to produce what obviously ought to be done in making good welds is not as simple a matter as it might seem to be. A certain amount of well-directed effort must be expended in acquiring near perfection in welding and it is not an accomplishment that can be learned from observation or upon advice only, and it is desirable that physical efforts involved in learning the art be supervised, otherwise much time may be wasted in useless effort.

The beginner should learn the answers to his problems as he progresses with his exercises, and strive to make welds that meet requirements, starting with simple problems and advancing to the more difficult, as proficiency is acquired. He should learn to judge weld metal quality, to some extent, from the appearance of fractured welds made by him, and should include in his studies the strength and resistance of welds in order to better understand the relation of his work and that of an expert whose rating he is endeavoring to acquire. He should also approach the many problems confronting him with an appreciation of the responsibilities which will come to his lot once he has become a qualified welder.

It is well for the beginner to make a start by depositing metal in the easiest way possible, and under the direction of an experienced welder who should know how to instruct others. This latter provision is to keep the beginner from forming wrong habits in handling the torch and electrode; habits which, if persisted in, will retard his progress. Upon acquiring ability to make a sound deposit, further progress should not be difficult.

The beginner can congratulate himself when he is able to butt weld two pieces of mild steel, say, 6 in. long, 2 in wide and ¼ in. thick, lying in a flat position, and have the weld metal present a sound appearance when fractured. Another significant period in his progress is when he is capable of making a good fillet weld of the simplest form. Having acquired that proficiency, progress should be rapid.

As plate and structural steel welding heads the list in volume, it is logical that a beginner should qualify for the type of welds most generally used in such fabrication.

When welders are being qualified for pipe work, sheet metal, thin wall tubing, non-ferrous metal, etc., the operators should be examined as to their ability to make good welds of the type to be used in the particular field concerned.

The tests referred to later would be pertinent as qualitative, but not as quantitative tests.

Decision as to whether a man is fit to work on a certain job is not answered by how long he has gone to school or for whom he has worked, but by his ability to make welds that the particular job requires. It is desirable for the employer who wishes to qualify his welders to have as a guide, a typical method of qualifying, so that his own procedure may not be lacking in any important detail. It is also desirable for the student welder who wishes to advance into work for which qualification tests will be required, to know the nature of these qualification tests so that during the instruction period he can check his progress against the testing program which he knows must come before he can be accepted as a welder on important work.

The purpose in presenting the following specifications is to recommend a simple, standard method whereby the qualifications of an operator to make sound fusion welds may be determined at minimum expense. Where established Codes have been found to satisfactorily cover the qualification of operators welding in special fields, it is recommended that the regulations of such Codes be followed.

Recommended Specifications for Pre-Qualification Tests for Welders

Section I—Requirements

The applicant shall furnish full information regarding his previous training and experience. He shall be

†Consulting Engineer.

examined and show satisfactory knowledge on the topics listed in Section II. In case the work contemplated is of an unusual nature, he shall also be examined on such special topics as pertain thereto. The result of this examination should be recorded.

He shall prepare welded specimens in accordance with Section 3 which shall comply with the tests specified therein. In case the work contemplated will involve the making of butt welds, Test 1 shall be used, and if the butt welds are to occur in important work, such as heavy plate construction, boilers or other pressure vessels, Test 3 shall also be used. In case the work contemplated will involve the making of fillet welds, Test 2 shall be used, and in case the fillet welds are to occur in important work, such as structural steel, Test 4 shall also be used. Tests 1 and 2 may be made prior to Tests 3 and 4 in order to save unnecessary expense in case the former do not result satisfactorily. Entry should be made on the form as to whether the Quality Test is satisfactory, and the strengths developed in the Tensile Test should be recorded on this form.

Section II—Topics for Examination

For Gas and Arc Welders

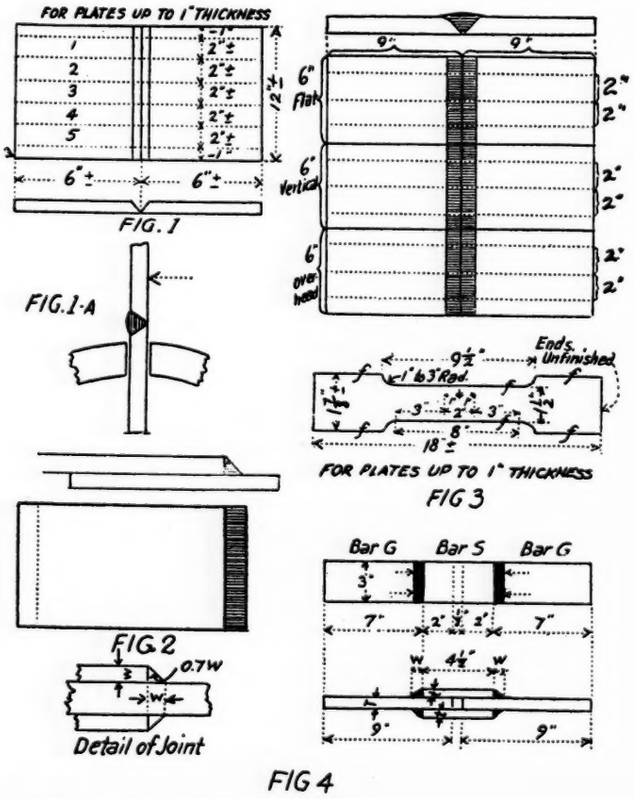
The meaning of "penetration."
The meaning of "fusion."
The meaning of "burned metal."
The value of reinforcement.

For Gas Welders

The meaning of "oxide inclusions."
Safeguarding the handling of cylinders, regulators, torches, carbide, acetylene, oxygen and the open flame.

For Arc Welders

Adjustment of regulating devices.



Effect of length of arc.
Relation between wire diameters and current strength.
Protection of themselves and others from radiations.

Section III—Tests

General.—Plates used in making specimens shall consist of low-carbon open-hearth steel, not exceeding 65,000 lb. per sq. in. ultimate tensile strength, whose surfaces shall be thoroughly cleaned and prepared for welding, except in cases where the operator is striving to qualify for a particular job in which other metal is to be welded, in which case welding wire suitable for the purpose should be used in making the qualifying welds. The specimens (required for Tests 1, 2 and 4) shall be welded in whatever position or positions (flat, vertical or overhead) will occur in the work contemplated. (The specimen for Test 3 shall be welded as specified below.) During the making of all test specimens the welding technique of the applicant should be observed. In the case of arc welding, he should be able to hold an arc of proper length in order to secure proper penetration and fusion, to select and maintain a proper current and to handle the electrode with a regular movement. In the case of gas welding, he should keep the welding tip clean, use a soft, neutral flame, secure proper penetration, float out the oxides, fuse the welding rod thoroughly with the base metal.

Quality Test—Butt Weld.—This test covers the preparation and testing of one specimen consisting of two plates each about 6 in. x 12 in., connected edgewise by means of a single Vee butt weld as shown in Fig. 1. The thickness of the plate, the angle of bevel and the depth of the shoulder below the bevel should be as close as practicable to those to be used on the job. Plates should be tacked or placed in position so as to insure that they will be reasonably flat after welding. Gas welders may make the weld with a single pass, but arc welders should be required to make the weld in two passes, the surface of each deposited layer being carefully cleaned with a wire brush or by chipping before applying the second layer. In both cases, the weld reinforcement should be 20% of the plate thickness. The weld should be made on the long dimension of the plates so that five coupons 2 in. wide can be secured. Only four of the coupons need be tested, but these should be selected so as to include at least one of the outside coupons.

The coupons cut from each specimen should be bent in a vise with the bottom of the Vee on the outside in such a manner as to break through the weld metal (Fig. 1-*A*). The weld metal should then be examined for cleanliness of deposit, penetration, fusion and soundness.

Quality Test—Fillet Weld.—This test covers the preparation and testing of one specimen consisting of two plates each about 4 in. or 5 in. wide, connected by means of a fillet weld as shown in Fig. 2. The thickness of the plate should be the same as that of the material to be used on the job.

The specimen should be prepared by laying one plate over the other so that the end of the top plate is set back from the end of the bottom plate a distance equal to four times the thickness of the plate, a full fillet weld being deposited in the corner thus made. The weld

shall be tested by inserting a suitable wedge between the two plates, breaking the weld in this manner and examining the deposit for weld quality; that is, for proper dimension of the fillet, for cleanliness and dense structure of deposited metal, for uniform fusion with the base metal and for penetration at the root of the weld.

Tensile Test—Butt Weld.—This test covers the preparation and testing of one specimen consisting of two plates each 9 in. wide and 18 in. long, as shown in Fig. 3. The thickness of the plate, the angle of bevel and the depth of the shoulder below the bevel should be as close as practicable to those to be used on the job. One of the long edges of each plate should be beveled and the beveled edges set nearly together, so that the completed test plate will be approximately 18 in. x 18 in. A backing strip may be used if desired. The welding wire should either be mild steel bare-wire conforming to the American Welding Society's Specifications, the equivalent thereto, or the same type that will be used on the work for which the operator is being examined. The record of the test should indicate that wire is used. The first 6 in. should be welded in a flat position, the second 6 in. in a vertical position, and the third 6 in. in an overhead position, if the welder is expected to work in all three positions. Any welding position not required on the job may be omitted from the test. Coupons 1¾ in. wide should be cut out of the center of each of these sections. All reinforcement and all metal which has been worked through beyond the bottom surface of the weld should be ground or machined off after the weld is completed. Each coupon should then be prepared as specified by the American Welding Society Committee on Standard Tests for Welds, a copy of which may be found.

These coupons when pulled in a tensile testing machine should show a minimum ultimate strength (in pounds per square inch of throat) of 85% of the plate strength, with an average of 90% of the plate strength for each pair.

Tensile Test—Fillet Weld.—This test covers the preparation and testing of one specimen consisting of two grip bars each 3 in. wide, 9 in. long and ½ in., ¾ in. or 1 in. thick, and two strap bars each 3 in. wide, 4½ in. long and ¼ in., ⅜ in. or ½ in. thick, respectively. The bars are to be welded as shown in Fig. 4. Each leg of the weld should be the same as the thickness of the strap. In the case of arc welds a single layer should be used for the two thinner specimens and two layers for the thicker specimen. The ends of the grip bars in each case should be separated about ½ in. All the pieces should be flattened if necessary and clamped to obtain perfect alignment and contact. Tack welding of the assembly is recommended. When pulled in the testing machine, the minimum load requirement should be 8000, 12,000 and 16,000 lb. per linear inch of weld, respectively.

The material in the foregoing recommendations has been compiled from the minutes of the meetings of the Committee on Qualification Tests for Welders of the American Welding Society of which the writer was chairman, and an acknowledgment is hereby made to all members of that committee for their splendid cooperation in its work.

Banking Oil-Fired Boilers

CONSIDERABLE trouble was experienced in a boiler plant equipped with oil-fired furnaces in banking and holding pressure within required limits overnight by the heat of the brickwork. It is possible that this same problem may arise in similar installations.

In the plant referred to, no boiler room attendant was on duty through the night, from 5 p.m. to 6 a.m. the following morning. If the burners were shut off too soon at shutting-down time, the pressure would be so low, and the furnace cooled off so much by morning, that considerable time and fuel would be lost in starting up. On the other hand, if the burners were operated until the last minute, the furnace temperature would be so high as to cause generation of steam through the night and the safety would blow frequently. This caused annoyance to occupants of the neighborhood and presented the danger of low water with a hot furnace.

As the load on the boilers during each afternoon was variable, the time required to cool sufficiently to close the dampers and boiler stop valves each day was different. The fireman had been guessing at it by the redness of the brickwork, but it was impossible to judge it correctly every time by this method.

A ¾-in. hole was drilled in the side of the brick boiler setting about 4 in. deep. A thermometer well of the 90° type was inserted in this hole and the space about the well was packed with fireclay. After several trials it was found that if the dampers and stop valve were closed when the temperature at this part of the furnace wall had dropped to 300°, 50% of rated steam pressure would exist at 6 a.m. the following morning when the operating department arrived to start up. Attempts to leave the plant with any higher temperature than this at this particular part of the furnace wall would result in loss of steam through the safety valves.

Although the required temperature and pressure in different boiler plants will vary, this same method should work out satisfactorily in plants of this type. —*Harry M. Spring.*

Fig. 1. Charging the ice tank of the ice cooling system in the Farmer Street Sales Office

Cooling Small Stores with Ice

By J. N. LIVERMORE, C. M. CLEMENS and P. S. HOSMAN†

THE Detroit Edison Company recently installed air conditioning systems for summer comfort in several of its sales offices. Since air conditioning is viewed as a growing field for the sale of electric power, these installations are expected to be of considerable advertising value. Also, it is expected that the experience and data gained will enable the company to answer more adequately the constantly increasing number of inquiries received on air conditioning. In these sales offices, central systems, using both ice and ice machines, and systems using cooling cabinets with direct expansion coils are now in operation and open to public inspection.

This article will describe two of the installations designed for the use of ice as a cooling medium, one at the Farmer Street sales office in Detroit, and one at the Port Huron sales office in Port Huron, Mich. Both of these installations were designed and erected by the company's construction bureau.

Farmer Street Sales Office

The Farmer Street Sales Office (Fig. 2) is situated in the heart of the downtown shopping district of Detroit, and occupies space in a substation building as shown.

The sales office was already provided with a ventilating system primarily intended for heating purposes. Fig. 4 shows the scheme of air distribution and method of winter temperature control as it existed. An air washer had been installed for cleaning the outdoor air supplied, and was used to give humidity control in winter and to lower by evaporation the temperature of air supplied in summer. This latter use of the air washer was not particularly satisfactory.

In designing a cooling system for this office it was desirable, from the standpoint of cost, to use as much of the existing ventilating equipment as possible. To this end, a simple test was made to determine whether or not the air distributing system was suitable for the delivery of air cooler then room air. On a day during the heating season, with the display room warm, the steam was shut off and all cold outdoor air was supplied. Smoke bombs were used to aid in observing the behavior of the air currents which resulted. To the surprise of those concerned, the cool air did not cascade from the grilles to the counters below, nor was it deflected into troublesome drafts by beams and columns. By the time the supply air reached the center aisle it appeared well diffused, and the air movement was too slight to be uncomfortable. From these observations it was concluded that the old duct system could be used without alteration.

However, the designers were less fortunate in some of the other phases of the layout. The fan room at the

†Design Engineers, Drafting and Survey Bureau, The Detroit Edison Company.

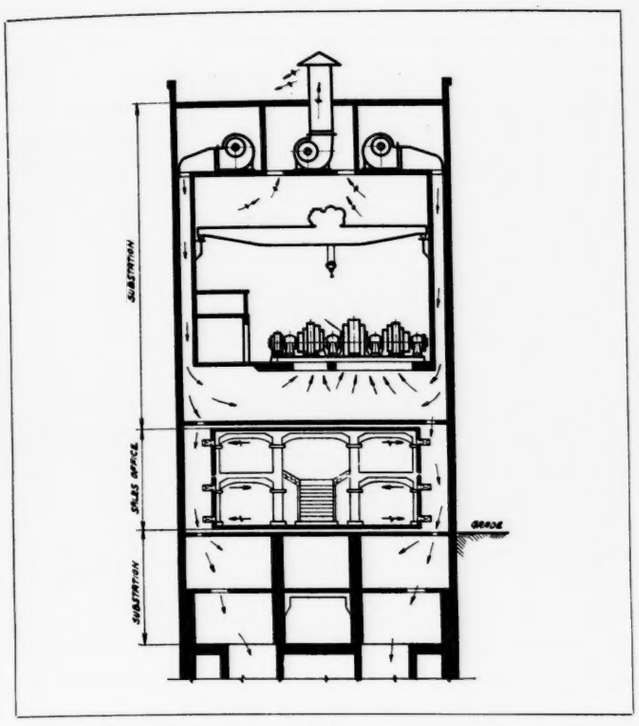


Fig. 2. Sections showing relation of sales office to the main building—Farmer Street Sales Office

rear of the sales office was already very cramped, and no additional room for the air cooling apparatus was to be had. As will be seen later, the cooling elements were suspended overhead, since that was the only usable space remaining. Likewise, there was no space in any part of the sales office for the water cooling equipment, and the only location suitable in the substation was at the end of the building farthest from the fan room, i.e., in the basement under the front sidewalk. Inasmuch as substation territory is carefully closed off and protected, it was desirable to install here the minimum of equipment, and only that requiring the minimum of attention.

The following tabulation presents an analysis of the heat sources within the sales office:

Analysis of Heat Load

1. Maximum outdoor temperatures assumed: dry bulb 95°, wet bulb 75°.....total heat 37.3 B.t.u. per lb.
2. Room temperatures to be maintained:
   mean room temperature—dry bulb..80°
   corresponding r.h. 45%
   total heat 29.7 B.t.u. per lb.
3. Heat to be absorbed:

Electric load	*Total watts*
Lamps	32,900
Appliances (refrigerators, etc.)	4,300
	37,200 watts
B.t.u. equivalent	127,200 B.t.u.per hr.

Occupants

10 persons (latent and sensible heat)..4,000 B.t.u. per hr.

Conduction

Side walls and ceiling neglected, (cooled by washed air from substation fans to basement)
Glass.....4,500 B.t.u. per hr.

Sun Effect

Neglected. Windows have awnings. Front and rear of sales office exposed to sun for very short time.

Infiltration

(Due to opening of doors, toilet ventilation, difference in vapor pressures.) Assumed as 2 changes per hour.
$60 \times (37.3 - 29.7) \times 3500$ c.f.m./14.0 =
114,000 B.t.u. per hr.

Total refrigeration .....249,700 B.t.u. per hr.
This is the equivalent of 20.7 tons of refrigerating capacity.

It will be noted that the electric lighting accounts for over half of the maximum cooling load. This lighting is used largely for display purposes and is expected to be continuously in use. Thus, in predicting the cost of operation of various schemes, the load to be encountered was known to a rather unusual degree of exactness, and was not expected to vary between wide limits during the cooling season.

Fig. 5 shows the scheme of air and water circulation on which the design of the system was based. The exhaust fan E draws air from the return duct A together with a small amount of filtered outdoor air from duct B. At the fan discharge are connected two banks of finned coils. Bank D is several coil sections deep while

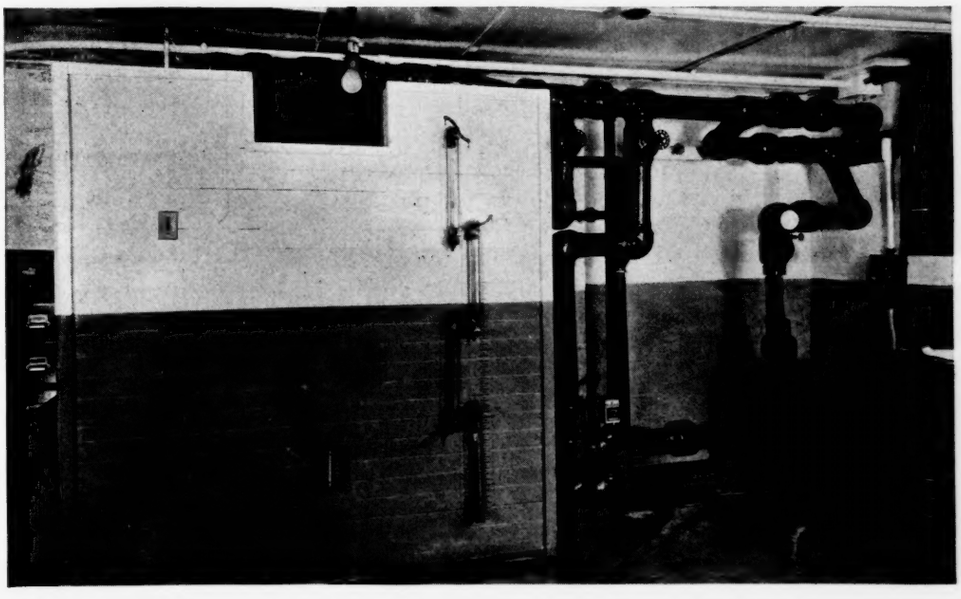


Fig. 3. Ice tank, electric mixing valve and circulating pump in the Port Huron office

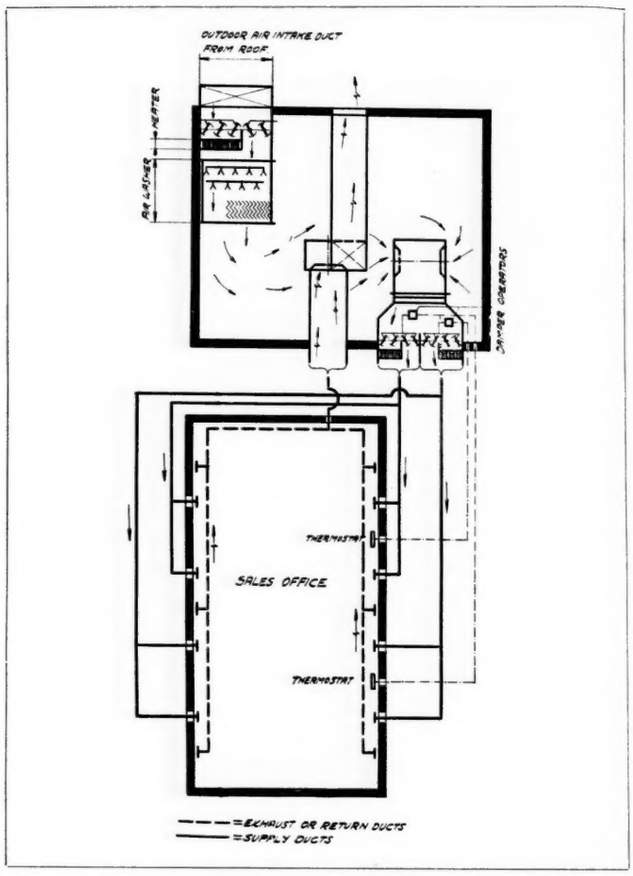


Fig. 4. Air distribution and temperature control arrangement before cooling equipment was added, Farmer Street Sales Office

bank G is only a single section deep. Cold water is supplied to the bank D which discharges into bank G. The air leaving section D is cooled below the entering dew point temperature and is therefore saturated. Air passed through section G is also cooled, but not to the entering dew point. A thermostat in the sales room controls the room temperature by calling for a warmer or cooler temperature of air from these two banks. The air leaves the cooling coils and discharges to the fan room which is closed tight and forms a part of the duct system. Supply fan S, which is run as nearly as possible at the same capacity as the exhaust fan, picks up the conditioned air and sends it back to the sales room through the supply ducts.

Room dew point temperature is controlled by maintaining a constant temperature of air leaving the deep coil. Since the air is saturated as it leaves the deep coil D, the control of its temperature at this point is also a control of its moisture content. To accomplish this a duct type of thermostat T, mounted at the outlet face of the deep coil, regulates the temperature of the water supplied to the coil so as to maintain a constant air temperature at the thermostat. The thermostat controls a pneumatically-operated three-way mixing valve which supplies the circulating pump with varying proportions of water withdrawn from the cold tank and warm water withdrawn from the cooling coil return line. The circulating pump runs continuously, supplying the cooling coils. Return water not demanded by the mixing valve is discharged into the cold tank.

Studies of total annual cost (fixed plus operating charges) were made, comparing the use of ice and the use of an ice machine. These studies showed a difference slightly in favor of the ice machine. However, the forementioned peculiarities of the space available for water cooling equipment, together with the company's desire to investigate this application of ice, brought about the decision to install an ice-cooled system.

An ice tank was erected in the substation under the front sidewalk, a location already suggested. Since it would require little attention, and could be designed without providing basement access for charging, the substation department had no objection to granting the space for this purpose. To keep within the restrictions imposed, it was necessary to design the tank in such a way that it could be charged simply by dumping ice through a hatch above, without requiring stevedoring of the cakes or any careful handling by the ice delivery men.

To avoid rehandling of ice after its delivery it was necessary to resort to the scheme of floating the ice in water. Few data were available on the design of such tanks, thus leaving the designers to many assumptions as to the behavior of ice when dropped into water. However, the following assumptions were made: that 2 ft. depth of water would be sufficient to cushion the shock of ice cakes dropped from a height of 9 feet; that the ice would float away from beneath the hatch without piling up and obstructing the delivery of a charge sufficient to carry through the maximum day; that with a minimum of 12 in. of ice floating in the tank, the temperature of the water would remain at 40° or below under any load conditions to be imposed, and that agitation of the tank, or spraying a mist over bare ice cakes

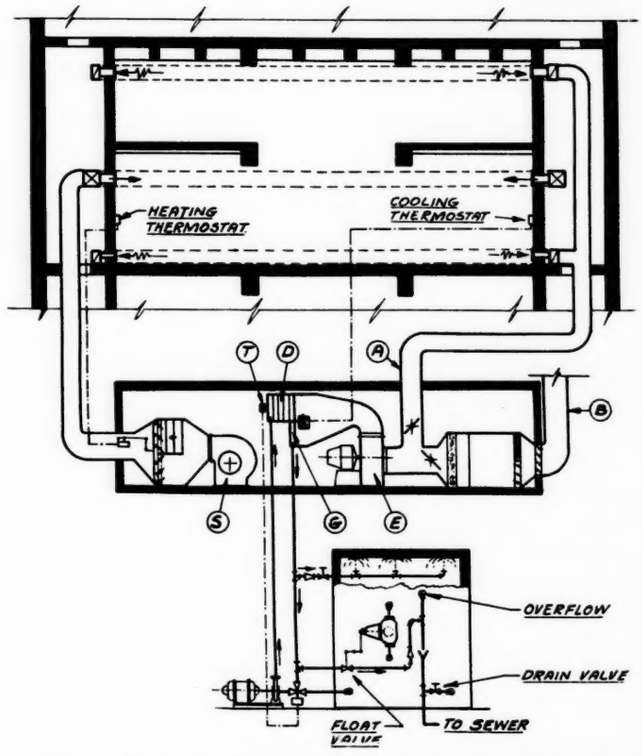


Fig. 5. Scheme of air and water circulation, Farmer Street Sales Office

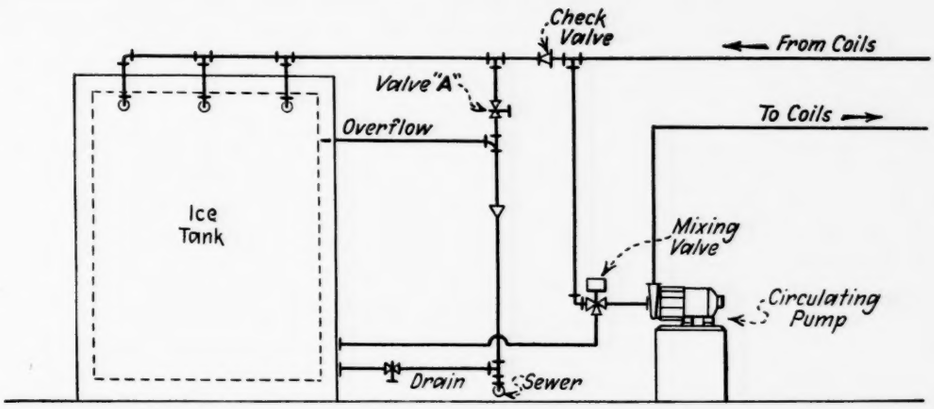


Fig. 6. Piping arrangement around ice tank, Port Huron office

would not be necessary to obtain the required rate of heat transfer.

The tank was to be used for a certain amount of experimental work, and to provide for this, a steel grating was installed 18 in. above the bottom. This would serve as a rack to hold the ice should it be desired to investigate the comparative advantages of spraying the ice rather than floating it. Moreover, this grating would protect the bottom of the tank from the impact of ice cakes at the time of charging.

The following computations outline the method used in arriving at the tank size:

Maximum quantity of ice to be melted in one day

Lighting load (constant) ..... 127,200 B.t.u. per hr.

Other heat sources—assume this load during day to average 70% of maximum instantaneous, or 70% × 122,500 = 85,750

212,950 B.t.u. per hr.

$$\text{Pounds ice melted per hour} = \frac{\text{Heat gained per hour}}{\left(\begin{matrix}\text{Heat of fusion}\\ \text{of ice}\end{matrix}\right) + \left(\begin{matrix}\text{Temp. rise of}\\ \text{melted ice to 55°}\end{matrix}\right)}$$

$$= \frac{212{,}950}{144 + (55 - 32)} = 1275 \text{ lb. per hr.}$$

Total ice melted—maximum day

9 hr. × 1275 lb. = 11,475 lb. = 5.74 tons

Size of tank

Assume horizontal area 14.5 ft. × 8 ft. or 116 sq. ft.

Volume of ice melted $\frac{11{,}475}{56.2}$ = 205 cu. ft.

Space required for ice (40% void) $\frac{205}{.60}$ = 342 cu. ft.

Depth required for ice: $\frac{342}{116}$ = 2.94 ft.

Depth required for residual ice	=	1.00
Depth required for grating	=	1.50
Clearance for internal piping	=	2.06
Total depth		7.5 ft.

Fig. 7 illustrates the general design of the tank. It is made of ¼-in. steel plate with all seams and joints arc welded. The insulation consists of two layers of 2 in. corkboard, set in hot Mexican oxidized asphalt with broken joints. The finished insulation was covered with a coating of cement plaster. While it was not proposed to spray the ice cakes, it did seem necessary to prevent short circuiting of warm return water through the tank by providing a fair distribution over the area in which the ice floats. Spray nozzles become stopped easily, and inside the tank they would be difficult to inspect or to clean. Thus, the design of the nozzle shown in Fig. 7 was adopted. In each is drilled a large (⅜ in. dia.) hole through which the return water is directed in a solid jet against the ceiling of the tank. This scheme worked out very nicely. When the system is in operation the space above the ice is completely filled with a rain of return water spattering off the tank ceiling.

Considerable thought was given to finding a simple and economical method of disposing of the water formed by the melting ice. Before the tank can be properly charged, the water level must be brought down to

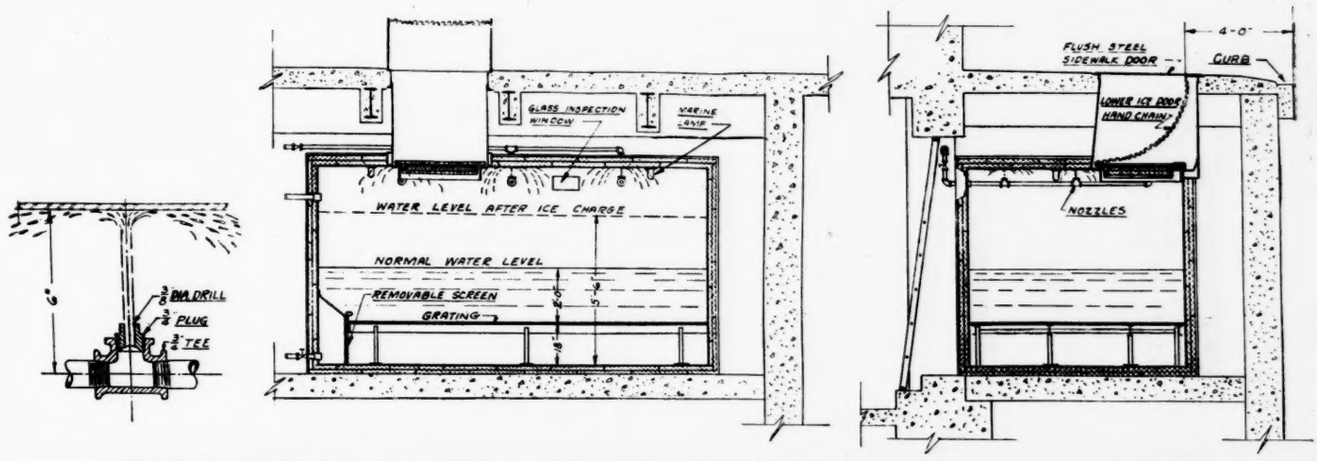
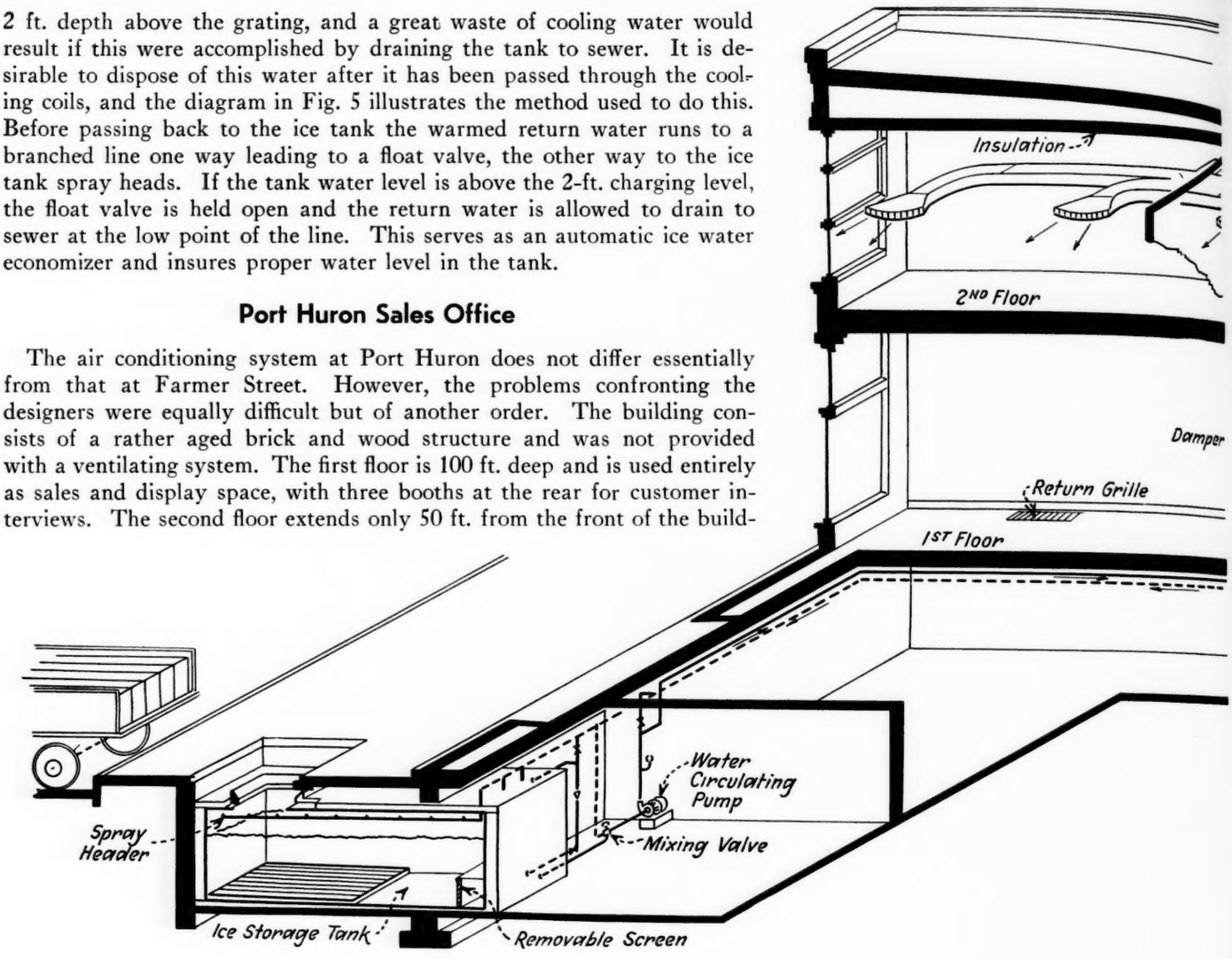


Fig. 7. (Left) Typical return water nozzle. (Right) Elevations of ice tank, Farmer Street Sales Office

2 ft. depth above the grating, and a great waste of cooling water would result if this were accomplished by draining the tank to sewer. It is desirable to dispose of this water after it has been passed through the cooling coils, and the diagram in Fig. 5 illustrates the method used to do this. Before passing back to the ice tank the warmed return water runs to a branched line one way leading to a float valve, the other way to the ice tank spray heads. If the tank water level is above the 2-ft. charging level, the float valve is held open and the return water is allowed to drain to sewer at the low point of the line. This serves as an automatic ice water economizer and insures proper water level in the tank.

Port Huron Sales Office

The air conditioning system at Port Huron does not differ essentially from that at Farmer Street. However, the problems confronting the designers were equally difficult but of another order. The building consists of a rather aged brick and wood structure and was not provided with a ventilating system. The first floor is 100 ft. deep and is used entirely as sales and display space, with three booths at the rear for customer interviews. The second floor extends only 50 ft. from the front of the building and houses a customer accounts and billing department. It was desired to cool the entire building, with the exception of the basement, and the appropriation for the accomplishment of this job was limited. Thus, an elaborate duct system, furred and concealed in keeping with the display room decoration, was out of the question. To further minimize first cost an ice-cooled system was chosen.



To reduce the cooling load, all the windows were fitted with awnings, and the entire roof was insulated with 4 in. of asbestos wool spread above the ceilings of the exposed portions of the first and second floors. The two long walls on either side of the building are of brick 13 in. thick and are in contact with neighbor walls of equal thickness and equal or greater height. With these conditions in mind it was found necessary to consider sun effect on the roof only. An outdoor air condition of 95° dry bulb and 50% relative humidity with a corresponding mean indoor condition of 80° dry bulb and 40% relative humidity was assumed as a basis for computing the following anticipated maximum cooling load: Conductance and sun effect, 32,100; infiltration, 97,800; lighting, 72,700; occupants, 12,390; total, 214,990 B.t.u. per hr.

Fig. 8 shows a complete outline of the system installed. The ice tank is located in an old areaway under the front sidewalk to which point ice may be readily skidded from a truck through the tank hatch. The tank is similar to the Farmer Sales Office tank and is designed to cool water by floating ice. The cold water is pumped to extended surface coils in a basement fan room. Stairways between the second and first floors and the basement serve as the main passageway for return air supplying the fan room. There is sufficient opening of doors and general building leakage so that a positive introduction of outdoor air into the circuit was not considered necessary.

With the exception of the booths, the first floor is cooled from a single diffuser. This design eliminated overhead ductwork altogether since the diffuser was connected directly to the riser supplying the second floor. Obviously, it would be difficult to obtain good distribution throughout so large a room from a single point of distribution. Foreseeing this, a diffuser with blades giving adjustment to horizontal direction of flow was designed. This provision proved to be of considerable value, and made a fair degree of distribution possible. Had vertical adjustment been provided also it would have been worth while, since it had to be added later.

Booths at the rear of the sales office could not be reached properly from the main diffuser, and it was

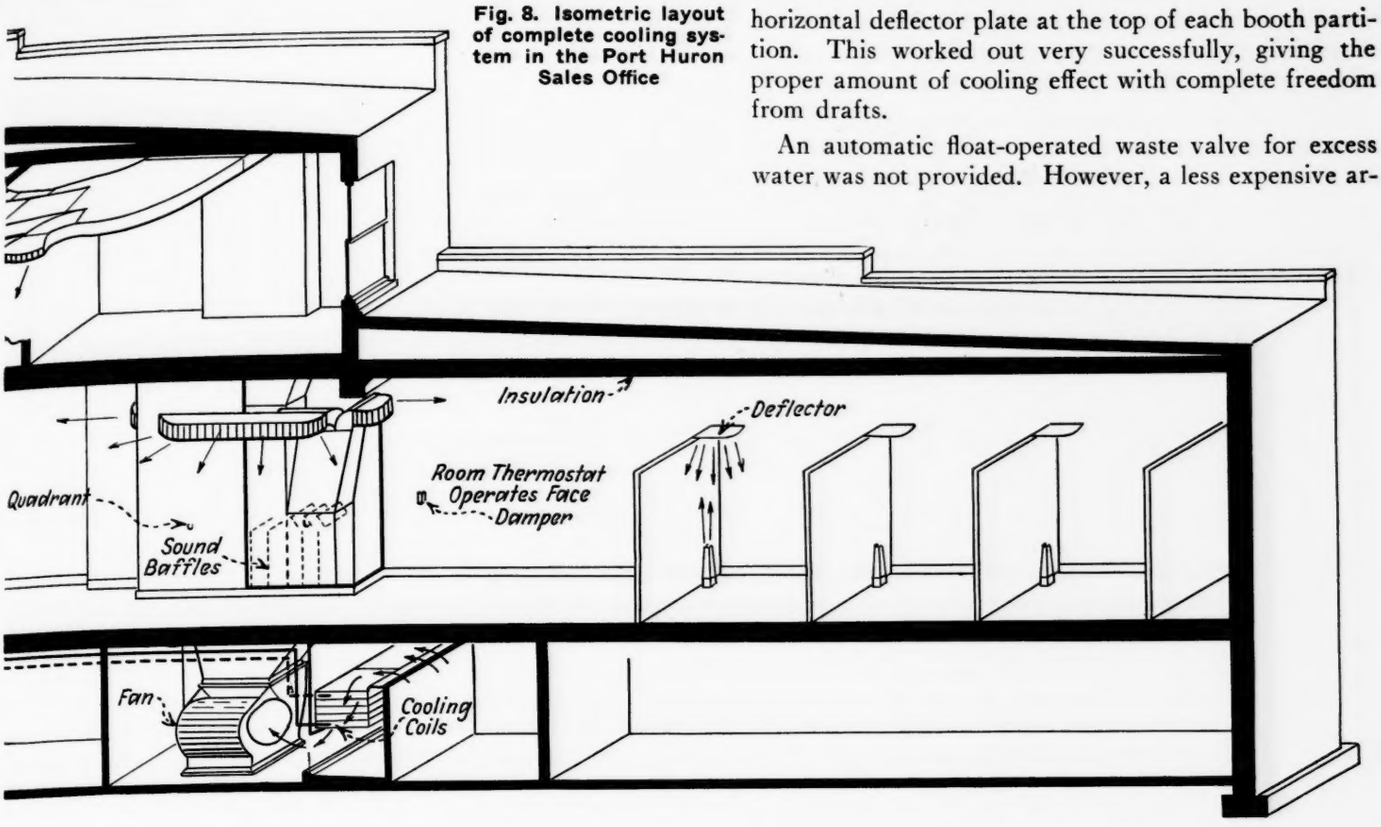


Fig. 8. Isometric layout of complete cooling system in the Port Huron Sales Office

horizontal deflector plate at the top of each booth partition. This worked out very successfully, giving the proper amount of cooling effect with complete freedom from drafts.

An automatic float-operated waste valve for excess water was not provided. However, a less expensive arrangement shown in Fig. 6 was installed. During a period when the load is at a maximum for the day, and the return water is at its highest temperature, an attendant opens hand valve A. This valve is left open until the water level in the tank has dropped to a point suitable for the next charge of ice.

necessary to connect a small supply duct to each. To make the ductwork as inconspicuous as possible and to avoid drafts in the small space to be cooled, a rather novel method of air introduction was used. Through the floor in the corner of each booth a nozzle was projected so as to jet air straight up striking against a

Building Construction in Recent Years

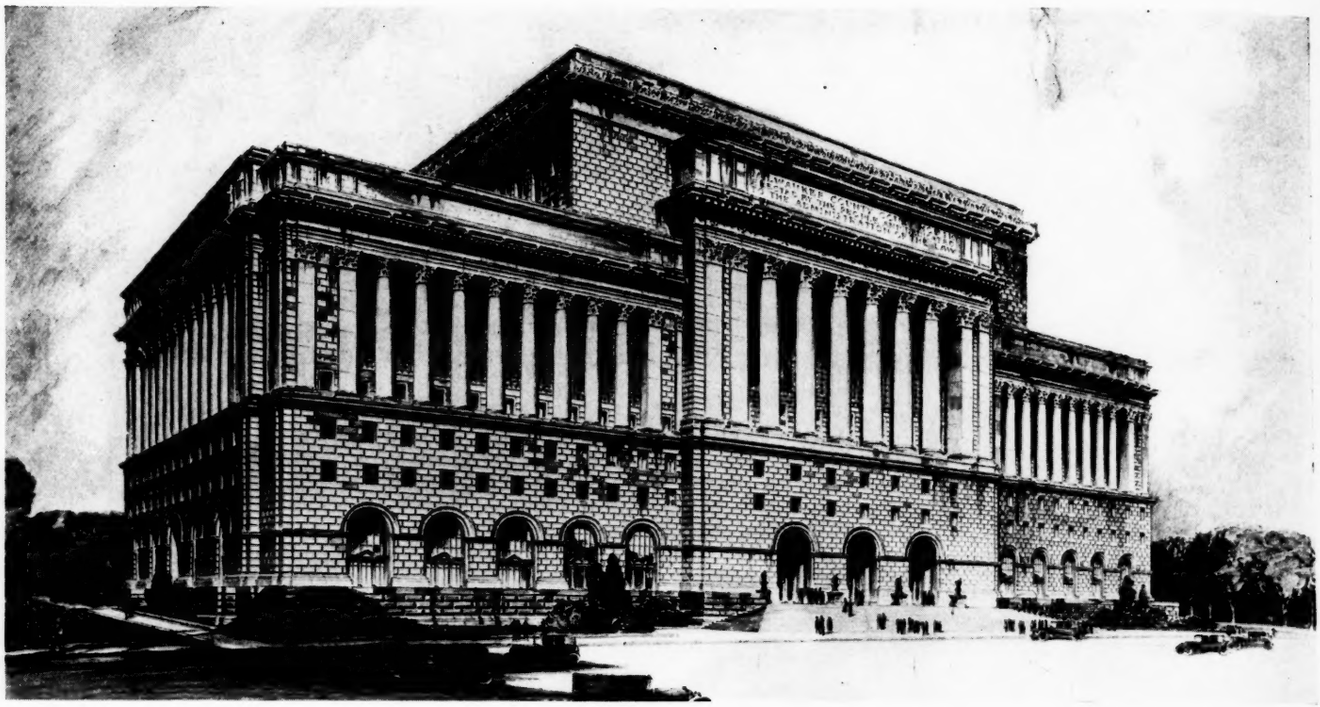
THE extent to which the construction industry has suffered during the depression is pointed out by Frederick C. Mills in the current bulletin of the National Bureau of Economic Research. Mr. Mills says:

One of the major forces in the post-war industrial expansion was the growth of construction. The accumulated building shortage left by the World War stimulated an exceptionally heavy volume of construction of all sorts, and the lifting force of this activity was felt throughout the industrial system. But here, as in the case of capital equipment and of durable goods in general, demand is elastic. Every rapid advance contains the seeds of potential contraction. Some of the details of the recent contraction are indicated by the figures in the table.

Here we have those productive elements which have been most seriously affected by the economic depression. The aggregate value of total construction in 1932 amounted to about one-fifth of the value at the peak of activity, while the volume amounted to approximately one-quarter of the peak volume. The sharpest contraction occurred in residential buildings. Activity in this field in 1932 constituted only 15% of that in 1927, and a still smaller fraction of the peak year volume. Public works, cut to about one-half of the peak volume, stood in the most favorable position among construction activities. But the drop here, deferred until after the 1930 season, was sharp between 1931 and 1932.

INDEX NUMBERS OF CONTRACTS AWARDED, 37 STATES, DEFLATED BY INDEX NUMBERS OF CONSTRUCTION COSTS

Year	Total Construction All Types	Residential Buildings	Non-Residential Buildings	Public Works and Utilities
1927	100	100	100	100
1928	105	109	102	105
1929	92	74	101	104
1930	77	44	77	119
1931	58	38	53	90
1932	29	15	25	52



Albert R. Ross, Architect *Sprague Engineering Company, Heating and Ventilating Engineers*

District Steam Heats New Milwaukee County Court House

Utility-supplied steam found more economical than independent power plant—Load amounts to 50,000 lb. per hr.—Duplex sleeve expansion joints used throughout

By HAL C. KIMBROUGH†

SINCE the crash in 1929, district heating has fared much better than most other industries. Many projects have been started and extensive additions have been made to existing plants. As a result, the district heating industry has frequently been referred to as a relatively depression-proof business. This is not hard to understand when one considers the many economies effected by district heating and the circumstances which often surround the extension of an existing district heating system.

One case which illustrates these points is the new Milwaukee County Court House. The architect, Albert R. Ross, originally planned to build a power plant. His further investigations showed it most economical for the county to contract for both steam and electric service with The Milwaukee Electric Railway and Light Company. The result was a 4500 ft. addition to the steam lines of the Milwaukee company. The architect's decision brought with it both electric and steam loads. Had The Milwaukee Electric Railway and Light Company been unable to supply steam, it is quite probable that the power house would have been built and the utility company would have lost the electric load.

With three power plants and one standby plant, the Milwaukee company was well equipped to take on the extra load. From the Commerce Street power plant of the utility company was run a 14-in. feeder main in a tunnel big enough to permit the installation of other lines. As a result, the utility is now in a position to extend its service along the route of the new main.

With the Milwaukee Court House contract alone, the utility secured an ultimate load of 50,000 lb. per hr.

†Western District Manager, American District Steam Company.

At present, however, only about 60% of the building is being utilized. Those sections not occupied are being heated sufficiently to prevent freezing.

Besides being a relatively depression-proof industry, district heating helps the unemployment situation wherever a job is in progress, since every contract requires common labor. In the case of the Milwaukee Court House job the construction of the tunnel presented some unusual conditions, all of which increased the labor factor. The depth of the tunnel ranged from 10 ft. at the Commerce Street power plant, which is an immediate source of steam supply, to a depth of 50 ft. to 55 ft. over practically all of the distance. The major portion of the tunnel had to be built under air pressure. Delivering materials in and out of the tunnel was accomplished by shafts approximately 500 ft. apart along the route of the tunnel. These shafts were maintained throughout the construction period. They were built of concrete and were provided with round manhole tops at the street surface for easy access to the tunnel.

For the greater part of the distance this tunnel is 6 ft. in diameter with 7-ft. diameter sections where expansion joints are located. Where the line connects to the low-pressure distribution system, the tunnel was also made 7 ft. in diameter for a stretch of 350 ft. in order to permit the installation of the large piping necessary to reduce the flow of steam before entering the distribution system. During construction of the tunnel, there was included in the concrete work at definite locations specially-poured bases, to template, for anchor base and guides, with rollers as well as bases, for the expansion joints. These bases and forms were constructed according to plan of the engineering department of the Milwaukee company.

In addition to the installation of the 14-in. principal steam main, various connections were made to the original heating system, greatly increasing the capacity of mains in the vicinity of the new court house. All of these mains were installed by the Northeastern Piping and Construction Corporation, the policy of which is to give as much employment as possible to local labor, thereby improving conditions in the sections where the work is being done.

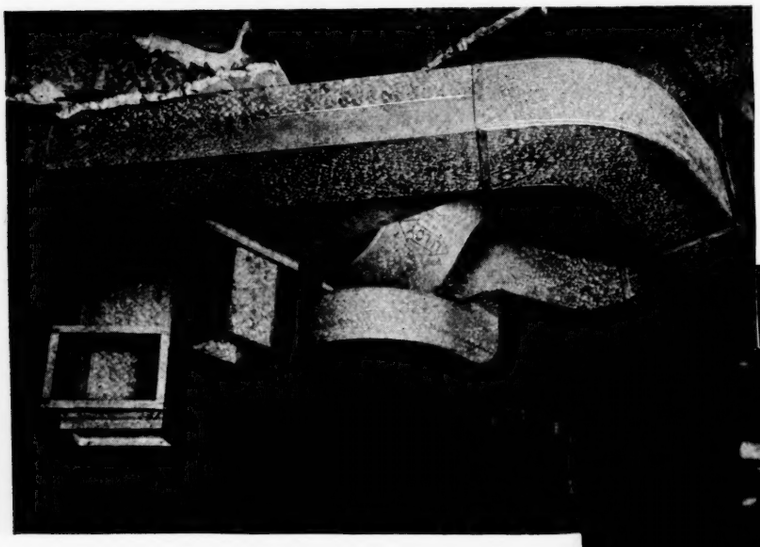
Due to its activities and expansion, the Milwaukee utility company will be in a better position to profit materially when business assumes normal proportions. Today its heating system consists of three power houses and one standby station, with modern tunnel and concrete conduit construction carrying 160 lb. and 250 lb. high-pressure mains, and from 2 lb. to 35 lb. low-pressure mains. Customers numbering 977—comprised of 865 business buildings and hotels and 112 residences and apartments totaling 236,987,917 cu. ft. of heated volume—are served with 1,234,984,357 lb. of low-pressure steam and 104,301,223 lb. of high-pressure steam. Throughout, the new addition was in keeping with the high character of the plant facilities that the Milwaukee utility has built up through the years. Duplex sleeve expansion joints, externally guided, of the welded type, were selected for the 250 lb. pressure main. Particular study was given to the anchor bases and their position on the expansion joints to reduce shrinking strain and to provide easy access to the anchor bolts. Elimination of excess packing with a resulting lower maintenance cost was insured by the selection of air-cooled sleeve expansion joints.

By adding to its facilities at this time, The Milwaukee Electric Railway and Light Company was able to take advantage of the low prices prevailing on materials and labor; to give needed employment to a large number of men, and to acquire available contracts that justified this extension, and place itself in a position to extend its steam service to many other customers adjacent to the line, with increased capacity to the distribution system through tie-in connections in the county building district.

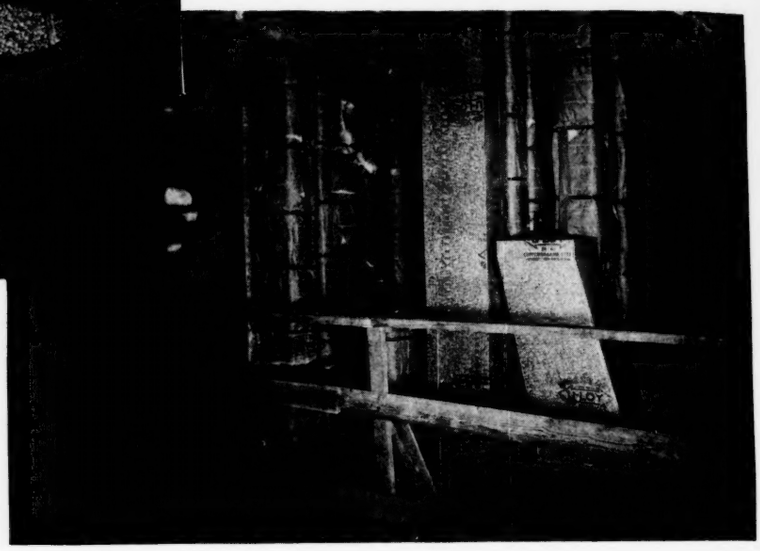
North Eighth Street tunnel carrying main and return lines, The Milwaukee Electric Railway and Light Company district heating system

Air Conditioning a Broadcasting Studio

Construction photographs of the ductwork serving the 27 N.B.C. Studios in the 70-story central tower of Radio City

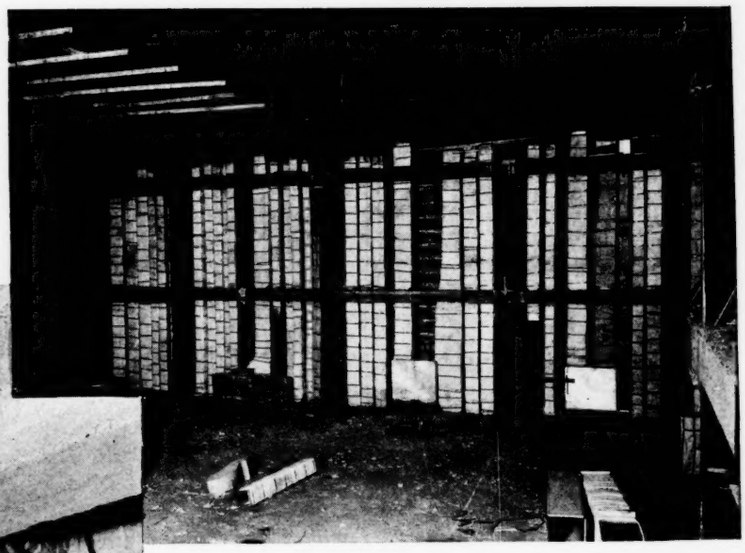


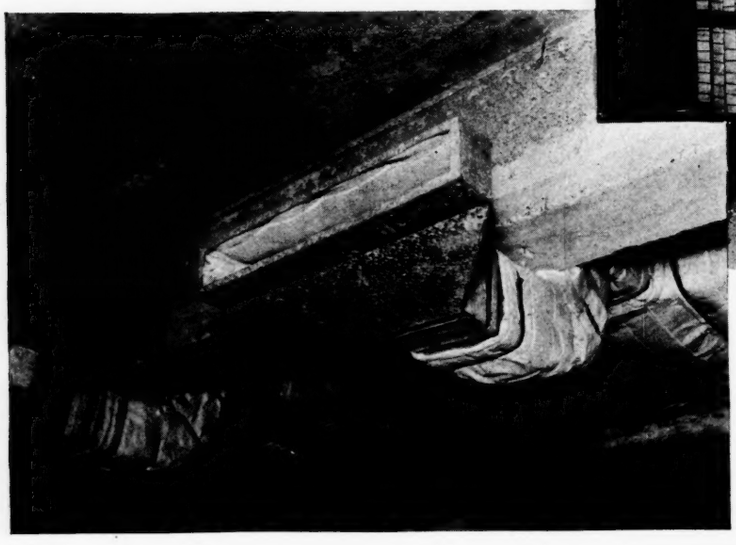
(Left) This complicated ductwork is typical of the distribution system for miscellaneous spaces not requiring extreme precautions in soundproofing. Note, however, the segregating sound isolation material between certain ducts, and the isolating supports from the building structure. All ductwork was erected from 1/8 in. scale plans prepared by Clyde R. Place, consulting engineer.



(Right) Each duct in this shaft is sound-isolated with exterior wrapping. Sound isolation is of paramount importance in these studios, as present-day microphones are of extreme sensitivity, and pick up sounds of such low intensity that they are not ordinarily detectable by the ear. All grilles are of special streamline design.

(Right) Half of a duct shaft which extends 10 stories high, the full width of the building, and contains over 80 soundproofed ducts. In many cases where the ducts must be soundproofed, the straight duct would be too short to hold enough soundproofing materal, so that the duct is turned back to increase its length.

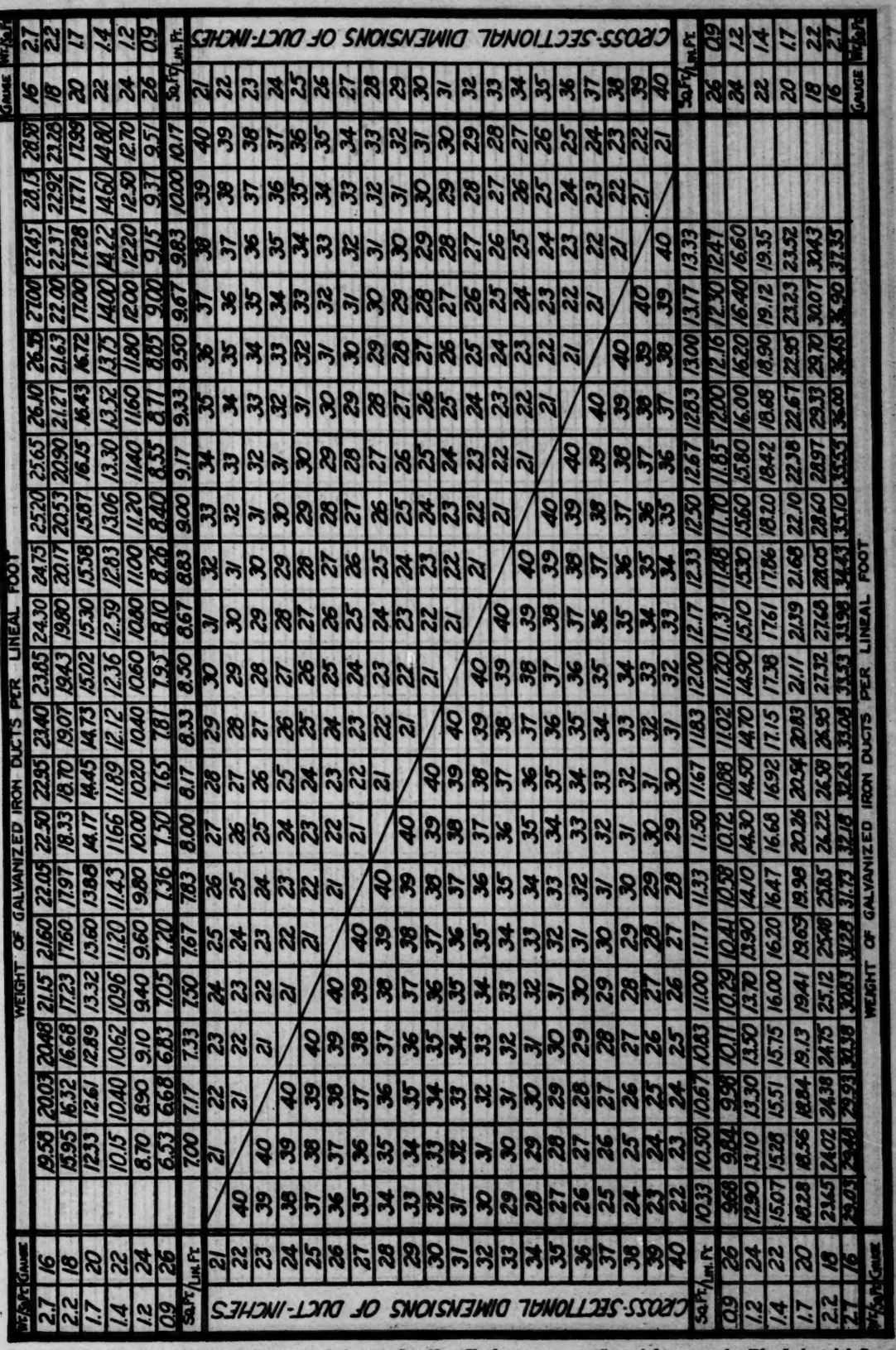




(Left) Typical foyer supply duct showing soundproofing both inside and outside the ducts which feed non-draft producing outlets of special design. The wall will be flush with the outlets, not erected when this photograph was taken. In addition, a special floating wall, floor and ceiling soundproofing is used, the combined wall insulation being alone sufficient to render the sound of a subway train inaudible.

ESTIMATING DUCTWORK

Weights of Rectangular Galvanized Steel Ducts per Foot—21" x 21" to 40" x 40"



Published by Heating and Ventilating, 148 Lafayette St., New York.

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H. & V.'s REFERENCE DATA—5

ESTIMATING DUCTWORK

Weights of Rectangular Galvanized Steel Ducts per Foot—21" x 41" to 40" x 60"

21" x 41" to 40" x 60"

WEIGHT OF GALVANIZED IRON DUCTS PER LINEAL FOOT

Wt. Lbs. per Sq. Ft.	Gauge	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	Sq. Ft. per Lin. Ft.
2.7	16	27.03	29.48	27.93	30.38	30.83	31.28	31.73	32.18	32.63	33.08	33.53	33.98	34.43	35.10	35.55	36.00	36.45	36.90	37.35	37.80	38.25	38.70	39.15	39.60	40.05	40.50	40.95	41.40	41.85	42.30	42.75	43.20	43.65	44.10	44.55	45.00	45.45	45.90	46.35	46.80	16
2.2	18	23.65	24.02	24.75	24.38	25.12	25.48	25.85	26.22	26.58	26.95	27.32	27.68	28.05	28.60	28.97	29.33	29.70	30.07	30.43	30.80	31.17	31.53	31.90	32.27	32.63	33.00	33.37	33.73	34.10	34.47	34.83	35.20	35.57	35.93	36.30	36.67	37.03	37.40	37.77	38.13	18
1.7	20	18.28	18.56	18.84	19.13	19.41	19.69	19.98	20.26	20.54	20.83	21.11	21.39	21.68	22.10	22.38	22.67	22.95	23.23	23.52	23.80	24.08	24.37	24.65	24.93	25.22	25.50	25.78	26.07	26.35	26.63	26.92	27.20	27.48	27.77	28.05	28.33	28.62	28.90	29.18	29.47	20
1.4	22	15.05	15.28	15.52	15.75	15.99	16.21	16.45	16.68	16.92	17.15	17.39	17.60	17.85	18.20	18.42	18.66	18.90	19.12	19.35	19.60	19.83	20.06	20.28	20.53	20.80	21.00	21.20	21.48	21.80	22.05	22.30	22.52	22.75	23.00	23.23	23.48	23.68	23.95	24.18	24.40	22
1.2	24	12.70	13.10	13.30	13.50	13.70	13.90	14.10	14.30	14.50	14.70	14.90	15.10	15.30	15.60	15.90	16.00	16.20	16.40	16.60	16.80	17.00	17.20	17.40	17.60	17.80	18.00	18.20	18.40	18.70	18.90	19.10	19.30	19.50	19.70	19.90	20.10	20.30	20.50	20.70	20.90	24
0.9	26	9.73	9.90	10.04	10.20	10.35	10.49	10.65	10.80	10.95	11.10	11.27	11.40	11.56	11.79	11.92	12.09	12.23	12.39	12.54	12.69	12.83	13.00	13.17	13.33	13.50	13.67	13.83	14.00	14.17	14.33	14.50	14.67	14.83	15.00	15.17	15.33	15.50	15.67	15.83	16.00	26
Sq. Ft. per Lin. Ft.		10.33	10.50	10.67	10.83	11.00	11.17	11.33	11.50	11.67	11.83	12.00	12.17	12.33	12.50	12.67	13.00	13.17	13.33	13.50	13.67	13.83	14.00	14.17	14.33	14.50	14.67	14.83	15.00	15.17	15.33	15.50	15.67	15.83	16.00	16.17	16.33	16.50	16.67			Sq. Ft. per Lin. Ft.
		CROSS-SECTIONAL DIMENSIONS OF DUCT-INCHES																																								
0.9	26	12.84	13.00	13.14	13.29	13.44	13.60	13.74	13.91	14.11	14.27	14.43	14.58	14.73	14.89	15.02	15.19	15.34	15.48	15.63																						26
1.2	24	17.00	17.20	17.40	17.60	17.80	18.00	18.20	18.40	18.70	18.90	19.10	19.30	19.50	19.70	19.90	20.10	20.30	20.50	20.70																						24
1.4	22	19.85	20.08	20.28	20.53	20.80	21.00	21.20	21.48	21.80	22.05	22.30	22.52	22.75	23.00	23.23	23.45	23.68	23.95	24.18																						22
1.7	20	24.08	24.37	24.65	24.93	25.22	25.50	25.78	26.07	26.41	26.78	27.06	27.34	27.63	27.91	28.19	28.48	28.76	29.04	29.33																						20
2.2	18	31.17	31.53	31.90	32.27	32.63	33.00	33.37	33.73	34.28	34.65	35.02	35.38	35.75	36.12	36.49	36.85	37.22	37.58	37.95																						18
2.7	16	38.25	38.70	39.15	39.60	40.05	40.50	40.95	41.40	42.08	42.53	43.00	43.43	43.88	44.33	44.78	45.23	45.68	46.13	46.58																						16
Wt. Lbs. per Sq. Ft.	Gauge	WEIGHT OF GALVANIZED IRON DUCTS PER LINEAL FOOT																																								Gauge
		CROSS-SECTIONAL DIMENSIONS OF DUCT-INCHES																																								

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Proper Methods of Applying Boiler Compounds

INTRODUCTION of boiler compounds into steam heating boilers to effect feed water treatment for prevention of scale formation, corrosion, or foaming, has various degrees of merit, but such compounds are often injurious to the heating system if used without caution. Frequently, when a moderate-sized heating system is installed, no provision is made at the time of installation in the boiler feed-water piping for applying boiler compounds into the boiler feed-water.

On this account operating engineers will often pour the concentrated boiler compounds in the vacuum pump receiver, because it affords a suitable inlet. While this may seem harmless, however, several vacuum pump manufacturers confirm the fact that they attribute some service troubles to this source. A strong alkaline compound solution going through the pump attacks and dezincs the brass pump parts, such as impeller, nozzles, casing and valves. When this takes place the brass becomes spongy and can often be whittled away with a knife.

Fig. 1 shows a vacuum pump with a compound reservoir made up of pipe fittings and connected in the vacuum breaker piping leading from the pump receiver. Thus the compound will mix with the condensate and feed water in the pump before it is forced into the boiler. This may or may not affect the pump, depending on the circumstances and the nature of the compound.

In some cases boiler compounds, when poured in the receiver, form a jelly-like substance which adheres to the pump impellers and shaft. This adhesion adds friction to the rotor and requires a greater power consumption. At times the pouring of the concentrated compounds in a mass will bring about a precipitation of the scale-forming salts in the water, which will deposit on the inside of the receiver and pump parts. All this necessitates taking the pump apart oftener than would ordinarily be required.

Some engineers have installed compound reservoirs made up of pipe and fittings properly valved in the boiler feed piping, as shown in Fig. 2. One satisfactory method is the use of a compound pot feeder which is connected in the pump discharge. (See Fig. 3). A shut-off cock, drain valve at the bottom, as well as an easily removed cover facilitates application of the liquid. With this arrangement the boiler compound will not affect the pump, unless a wrong compound or too great a quantity is used. Too much compound may make the water highly acid or alkaline, as the case might be. Many cases are known where this has caused radiator traps to go dead, because the trap diaphragms would become eaten away.—*John A. Masek*

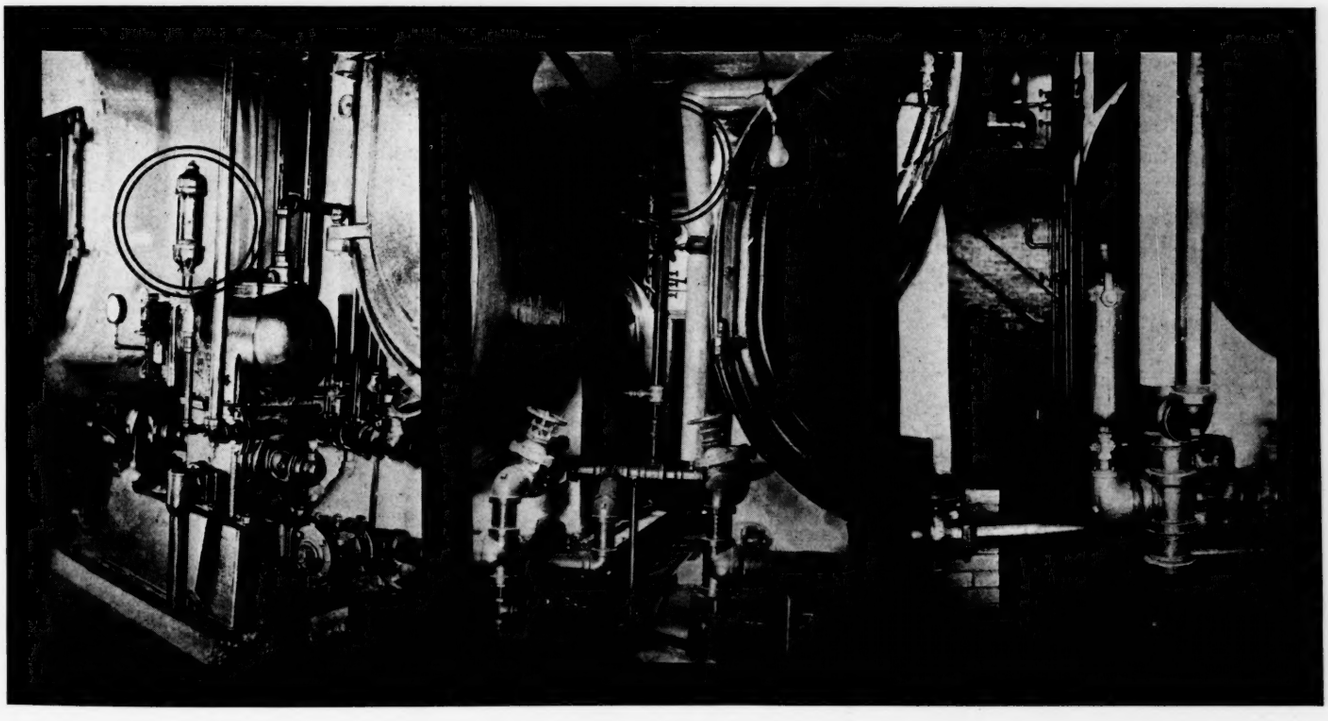


Fig. 1. Home-made compound reservoir, improperly connected because the compound goes through the vacuum pump first

Fig. 2. Proper method of connecting compound reservoir in boiler feed piping. The compound is thus diluted before entering the boiler

Fig. 3. A compound pot feeder manufactured by a chemical company. It is connected to the pump discharge

Requirements for Heating, Piping and Ventilating Work in Federal Buildings

By G. KENDRICK BRINGHURST†

DURING the past fifteen months there has probably been more Federal construction authorized than for any other period in the history of this nation. Post offices, court houses, hospitals, and other classes of government buildings, ranging in cost from thousands to millions of dollars, have been distributed throughout the forty-eight States. In many instances, particularly for the larger projects, the commissions for the designs have been awarded to private architects, and these in turn have engaged the services of consulting engineers to design the heating, ventilating, plumbing and electrical installations.

The independent engineer, when engaged in connection with this type of work, should make himself thoroughly familiar with Federal requirements before proceeding with any design. Otherwise, he is liable to find it a long drawn out process and not especially profitable, with voluminous correspondence and many trips to Washington before his plans receive the final Governmental O.K.

Government engineers, whose approval is necessary before any plans or specifications can be let out for bids, have acquired through their years of experience in the maintenance of Federal buildings, a knowledge of what is essential, both to install and to omit, and it would seem logical to assume that their opinion in such matters is both wise and sound.

Certain instructions are issued to engineers by the Office of the Supervising Architect, Treasury Department, and the following information is taken from these instructions, and from personal experience with the wishes of the Department engineers.

For small and medium sized buildings, except where steam is taken from an outside source, one pipe steam distribution is to be used. With outside steam service, the system must be designed to meet this condition. For buildings with over 5,000 sq. ft. of direct radiation, vacuum systems are generally to be used.

Air leakage is to be figured for four air changes in mailing or entrance vestibules and one and one-half air changes in other rooms. The infiltration method may be used in lieu of the above if desired. In this connection, it is to be noted that the standard Office Specification for steel sash permits a leakage of 75 cu. ft. per hour per lineal foot of crack.

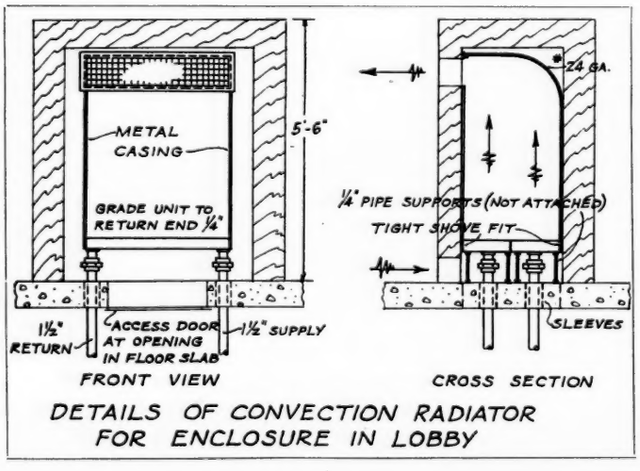
Steel boilers, single pass, with a capacity of not over 5,900 sq. ft. for the smaller buildings, and fire box, double pass, steel portable type for the larger buildings, are to be used. The engineer is cautioned to see that the architect provides a stack of ample cross section and height and, in general, a lined brick stack 21 in. × 21 in. inside dimensions should be provided for the smaller buildings.

Large buildings requiring over 30,000 sq. ft. of equivalent direct radiation are to be equipped with high pressure boilers and stokers.

The Steel Heating Boiler Institute method of specifying boiler sizes is to be followed, the size specified to be based on using coal containing 14,000 B.t.u. per pound. Where a coal of less heating value is to be used, allowance must be made by adding 10% to the capacity as determined by the S.H.B.I. method for each 1,000 B.t.u. below the standard. The actual capacity required should be specified regardless of whether this capacity corresponds to the catalogue rating of the boiler manufacturer.

The question of fuel will be determined by the Maintenance Division.

†Consulting Engineer, Philadelphia.



DETAILS OF CONVECTION RADIATOR FOR ENCLOSURE IN LOBBY

Typical treatment of converter (left), and of water heater connection (below)

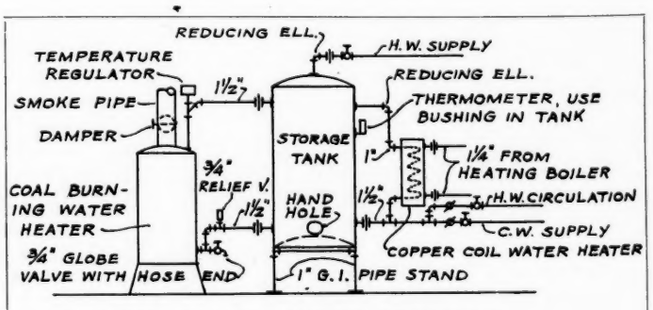


DIAGRAM OF WATER HEATERS AND TANK CONNECTIONS

The Office uses the actual superficial surface of radiators as measured by the Bureau of Standards in approving radiation. In nearly every case these measurements are less than those given in the manufacturers catalogs, thus requiring more sections to obtain a given number of square feet. Therefore, in laying out radiators on the plans they should be made about 10% larger than catalogue length to allow for the reduced rating. In limited spaces, a greater allowance may be necessary for some types. Where the total radiation in a building is 300 sq. ft. or less, the number of sections should be noted rather than the square feet. No fractions of square feet are to be given.

Unit heaters are not desired for heating post office spaces as the officials prefer direct cast iron radiation. Use of brass and other non-ferrous radiators should be kept to a minimum, but where used the specifications must permit wide competition.

Sizes of valves, stubs and runouts should all be noted on the plans or given in a schedule. All risers on drops serving more than two radiators should be valved.

The opening into stack for boiler breeching should be made about 1 in. larger than breeching for a brick flue, and 2 in. larger where a steel stack is used, and the height above floor of center line of steam main at boiler and center line or bottom of breeching should be noted on the plans. Use of trenches is to be avoided as far as possible.

Fuel-rooms should be provided on a basis of 1 sq. ft. for each 1,000 cu. ft. of gross cubic contents and in no case should be less than 500 sq. ft. Where the distance from boiler room floor to grade is 8 ft. or over, an ash hoist should be provided.

All court rooms should be provided with mechanical ventilation, based on about six air changes per hour. Other rooms in large buildings may also be provided with mechanical ventilation, depending on conditions. For post office workrooms, one and one-half to two air changes per hour are considered to be sufficient, and a strip 20 to 30 ft. wide next to outside windows may be considered as being adequately ventilated by natural infiltration and may be ignored in figuring fresh air requirements. Exhaust ventilation may be either gravity or mechanical, depending on conditions, and should be provided for about 80% of the fresh air supplied.

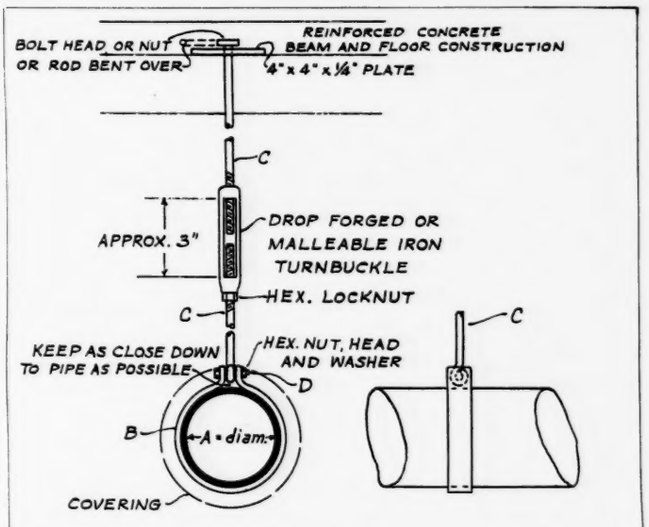
Automatic temperature control should be installed for all fresh air ventilating systems, but not for heating generally.

Air filters should be provided. Unless so directed by the Assistant Superintendent of the Mechanical Engineering Division, no air conditioning is to be installed.

Drinking fountains on the basis of one fountain for each 50 employees must be installed in all post office workrooms. A drinking fountain is also to be provided in each corridor on upper floors generally.

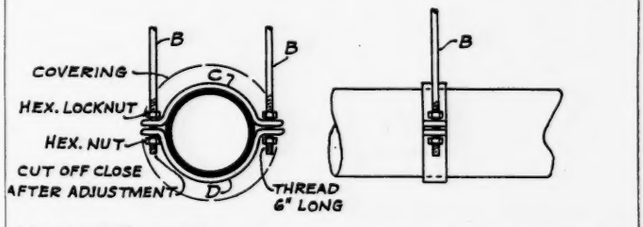
Individual combination electric water coolers and drinking fountains are to be used generally except in very large buildings, where consideration will be given to the installation of a centrally located refrigerating plant for cooling drinking water.

Attention is called to the fact that the capacities of electric water coolers as quoted by most manufacturers



HANGER NO. 2 - FOR ALL LOW PRESSURE STEAM, RETURN, WATER, AIR, GAS, SOIL, WASTE, VENT PIPES, ETC., AND FOR ELECTRIC CONDUITS.

HANGER NO. 2.				HANGER NO. 3.			
A	B	C	D	A	B	C	D
½	¾ x ⅛	¼	¼	½	¼	¾ x ⅛	¾ x ¼
¾	1 x ⅛	¼	¼	¾	¼	¾ x ⅛	¾ x ¼
1	1 x ⅛	⅜	¼	1	¼	¾ x ⅛	¾ x ¼
1¼	1 x ⅛	⅜	⅜	1¼	¼	1 x ⅛	1 x ¼
1½	1¼ x 3/16	⅜	⅜	1½	¼	1 x ⅛	1 x ¼
2	1¼ x 3/16	⅜	⅜	2	¼	1 x ⅛	1 x 5/16
2½	1¼ x ¼	½	⅜	2½	¼	1 x ⅛	1 x 5/16
3	1¼ x ¼	½	½	3	⅜	1¼ x ⅛	1¼ x 5/16
3½	1¼ x ¼	½	½	3½	⅜	1¼ x ⅛	1¼ x 5/16
4	1¼ x 5/16	⅝	½	4	⅜	1¼ x ⅛	1¼ x 5/16
4½	1½ x 5/16	⅝	½	4½	⅜	1¼ x ⅛	1¼ x ⅜
5	1½ x 5/16	⅝	½	5	⅜	1¼ x ⅛	1¼ x ⅜
6	2 x 5/16	¾	⅝	6	½	1½ x ⅛	1½ x ⅜



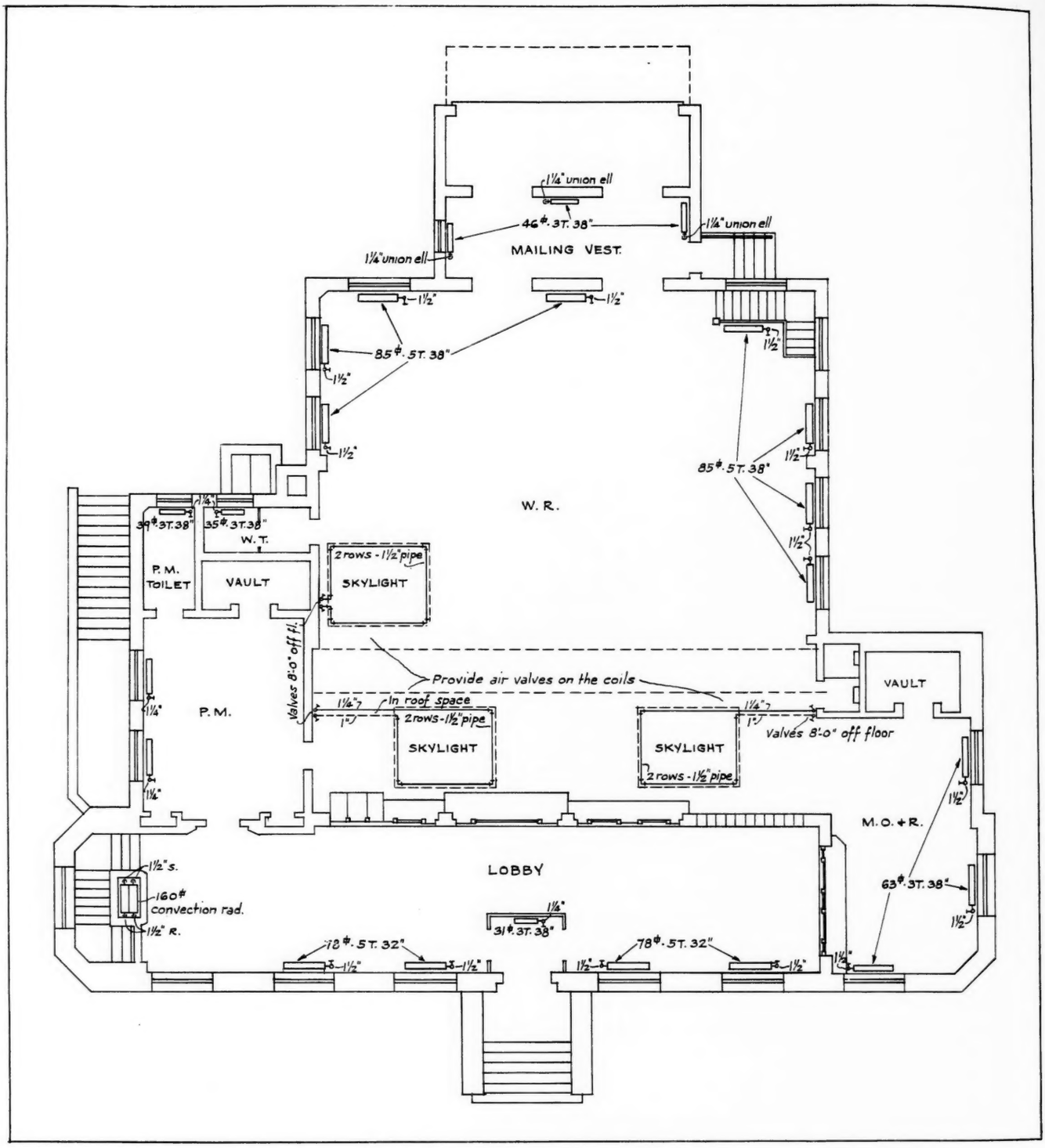
HANGER NO. 3 - FOR USE IN LIEU OF HANGER NO. 2 ONLY WHERE SPACE WILL NOT PERMIT USE OF TURNBUCKLE.

Standard pipe hanger details for Federal buildings

is based on the use of the waste water for precooling purposes and where the fountain is located so that waste does not pass through the cooler, the capacity will be greatly reduced. Combination outfits should be used wherever possible.

Indirect water heaters having copper coil submerged in a cast iron housing, in conjunction with either steam or water heating boilers, are to be used in all buildings where the plumbing fixtures requiring hot water do not exceed 12. In lieu of the copper coil heater, the heater may be of all cast iron construction for heating water by the same method. Larger buildings, and buildings with more than one boiler, are to have steam coils in the hot water storage tank.

The standard size of tracings in use in the office is 23 in. × 35½ in. inside of the border lines with a trimming line ¾ in. outside the border line. Tracings when



First floor plan of typical one-pipe steam heating layout for post offices costing less than $100,000

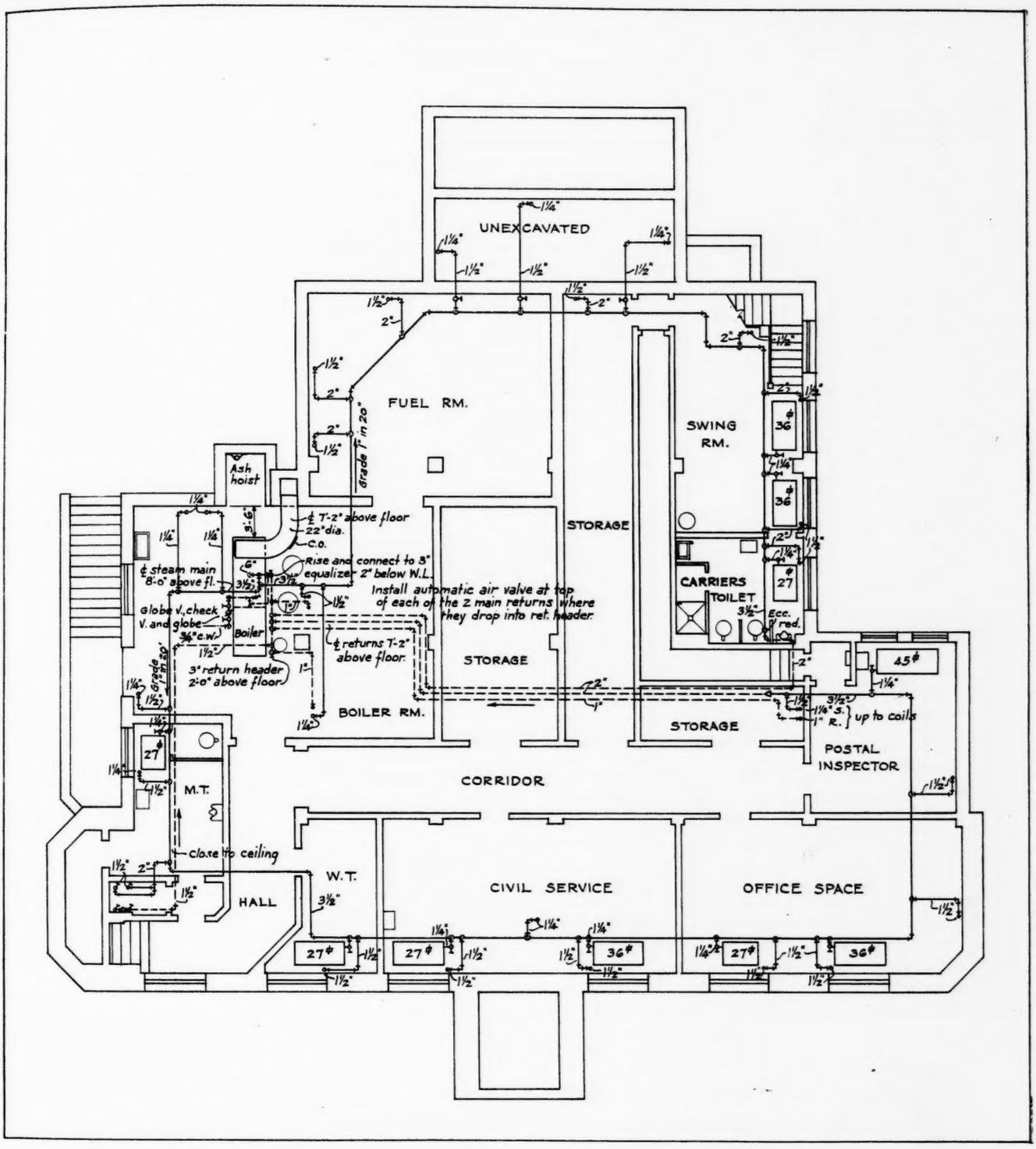
completed should be trimmed to about ⅛ in. outside the trimming line.

The maximum width of tracing which can be handled by the blue printing machines is 42 in.

The stamp for building title is to be placed in the lower right hand corner and the stamp for Supervising Architects title in the lower left hand corner. Floor titles and seals should be placed directly under plans and title designating work, viz: "Heating," "Plumbing," etc., should be placed midway between floor title and right hand border about 2 in. above bottom border line, using the lettering stencils. Drawing numbers should be obtained from and recorded in the book kept by the architect in charge of the particular building.

Separate basement plans must be made for each branch of the work where the scale is ⅛ in. to the foot. For floors above basement one set of plans is to be made for plumbing and heating and one set of plans for electrical work. Where the scale is ¼ in. to the foot a separate basement plan is to be made for the electrical work.

Each set of drawings must give the floor heights and



Basement plan of typical one-pipe steam heating layout for post offices costing less than $100,000

compass point. The elevations of basement or first floor should be noted on plumbing drawings. Titles of rooms must be noted but must be abbreviated so far as possible.

All tracings are to be cleaned up before being passed on from one engineer to the next in the progress of the work.

All vertical pipes are to be concealed in chases, furring, etc., or be run in lookouts or closets. Exposed vertical pipes above first floor should be kept to a minimum.

Pipe sleeves should be shown on the structural or architectural drawings for all pipes passing through footings or exterior walls below grade. Sleeves for cast iron pipe should be large enough to pass the hubs of pipes and those of steel pipe large enough to pass the beads of fittings. The elevations of sleeves need not be given except where passing through membrane water-proofing which requires a special sleeve with clamp.

Where floors are waterproof, all pits, cleanout manholes, trenches, etc., must be shown on foundation plan.

WOMEN OF

Olive E. Frank has been president of the O. E. Frank Heater and Engineering Co., Buffalo, N. Y., since 1924. For nine years preceding that she was sales manager of the Alberger Heater Company, in charge of engineering, sales and sales promotion. She is a member of the A.S.M.E. and the A.S.H.-V.E., and has several engineering patents to her credit.

For 25 years heating and ventilating has been familiar talk to Mrs. Arthur E. Rudolphi. She is president of the Rudy Furnace Co., Dowagiac, Mich., a position to which she was elected following the death of her husband, a founder of the company, in December, 1929. In addition, Mrs. Rudolphi is a director of the Rudy Acceptance Corporation, retailing financing firm.

For nine years Julie Polshek has been associated with The Warm Air Furnace Fan Co., Cleveland, Ohio. She holds the position of assistant sales manager and is kept busy handling direct-mail advertising, copywriting, sales correspondence and field contacts. She is a familiar figure at all the various expositions and conventions in the industry.

THE INDUSTRY

Margaret Ingels graduated in mechanical engineering in 1916 from the University of Kentucky and was for one year with the Chicago Telephone Company. This was followed by four years with the engineering department of Carrier Engineering Corporation and six years with the Research Laboratory of the A.S.H.V.E. Two more years with the New York Commission on Ventilation, and since then she has been associated with the Carrier-Lyle Corporation. Member, A.S.M.E. and A.S.H.V.E.

Eva B. Stark, associate editor of The Aerologist-Indoor Air, is Dr. E. Vernon Hill's right-hand "man." She has been doing advertising and editorial work for the past seven years, and is secretary of The Aerologist Publishing Company, Chicago.

Helen Hayes Peffer, managing editor of Refrigerating Engineering, is still new to our industry. She has been doing journalistic work for the past two and a half years with the American Society of Refrigerating Engineers, and the format and general readability of its publication clearly reflects her professional touch. She once taught journalism at the University of Illinois.

EDITORIALS

Action on Air Conditioning Nomenclature

RECENT announcement that a revised system of naming will be one of the projects to receive attention on the part of a trade committee newly-organized in that part of the air conditioning field which hopes to engage in merchandising, again calls attention to the demoralizing state existing. We have referred to this repeatedly and have long felt that the situation would have to be corrected. Just now no one knows what the term "air conditioning" means. In fact it has no definite meaning.

Fixing upon a term, or system of naming, which will be reasonably permanent and which can be expected to gain general recognition is distinctly a commercial function. It is not a simple one, however.

In the first place the committee will have to find some means of reconciling the opposing viewpoints which eixst within the industry itself. Having done this—and it will be no mean task—the real test will come when the recommendations are tried out on the general public. If the general public is to buy air conditioning, and merchandising plans necessarily presuppose that it will, it is reasonable to expect that public to want to know something about what it is getting. Therefore, the names used must be such that the public can understand and accept them.

The size of the educational job ahead can be judged when we realize that in spite of all the effort directed at the industry itself over a considerable period of time it is evident to anyone that many of our own people even now have no clear-cut understanding of the whole subject or even of its principles. If it has taken all this time and effort to get only a fair knowledge into the minds of a relatively few, how much longer will it take to get a fair understanding into the minds of many? We believe that the time will depend both on the clearness of the presentation and on the intensity of the effort used. Clearness of presentation can be secured only if a simple and understandable basis of naming can be worked out.

From every point of view this proposed work of the committee is important, timely, and difficult. We can all hope that the effort will be broadly handled with a full appreciation both of its importance and of the long-time effects which it may have. Too often similar committees have merely played around with like projects and have either ended up by recommending a conglomeration of all the personal opinions of their members or have let existing prejudices and trade jealousies neutralize any permanent good they might have accomplished.

The committee has hold of a real problem. The findings and results will be watched with interest by the whole industry.

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Accelerated Progress in Controls

AN unplanned result of recently going over some of the newer equipment, now available on the market, was to call our attention again to the present situation surrounding controls. Our reaction was the one likely to be experienced by anyone who really starts looking into this matter of operating controls, viz., astonishment at the number, variety, and ingenuity of these devices and at the rate at which they are being developed. This caused us to start thinking how rapidly the rise of automatic controls has taken place, and how much more generally they are accepted now than even ten years ago.

The oil burner, with its positive necessity for some kind of automatic control during operation, is responsible for giving impetus to the general acceptance, although the fact that earlier apparatus had been developed should not be overlooked. We do not agree with the statement so often made that the oil burner was what really started the use of automatic operating controls in our industry. What it did do was to greatly increase the rate of development and to cause attention to be directed along new lines.

What the oil burner started, the use of gas, coal stokers, and air conditioning continued until now the inclusion of some form of automatic controls is an accepted practice, not only on small plants and units but even in the largest buildings. Operating economy in large buildings is proving to be as powerful an argument to further the use of these controls as was operating convenience in the case of the residence installation.

With all the progress made and with all the variety of apparatus now available, it is evident to anyone, who will take the trouble to look, that this whole fascinating field of control is really both new and only comparatively little cultivated. Wonderful as our present controls seem, we have no hesitation in predicting that the progress of the next few years will make that of the last ten seem small in comparison. Interest is increasing, better and better talent is being attracted, and acceptance of the necessity of controls is growing. We look forward to the time when this industry will be as well known for the excellence of its controls as for the worth of the other parts of the plant. Overheating, overcooling, and all the rest of the gibes aimed at us in the past will definitely be things of the past.

Abstracts . . .

Reviews and Summaries of . . . . Current Papers, Books and Pamphlets

Sun Radiation Data Reported

TESTS on solar radiation at Penn State show that glass is practically transparent to the sun's rays, that metallic paints absorb more of this heat than non-metallic paints, and that white is the best color for preventing the absorption of heat from the sun, according to a paper presented by F. G. Hechler and E. R. Queer at the annual meeting of the refrigerating engineers. The data they present will further round out information on this source of heat gain, of considerable moment in the design of air conditioning jobs.

The authors set up a test box so arranged that they could change the character of specimens of material exposed to sun radiation, and could measure the surface temperatures and heat flowing through them, as well as the air temperature and wind velocity. They used surfaces formed over galvanized iron, asphalt shingles, slate, plywood, and glass. Their procedure was to change the nature and color of the surfaces and measure the corresponding changes of temperature and other factors. This permitted them to evaluate the effects of these surface changes and to conclude which have the more desirable properties.

They also made some tests on glass to learn if it is opaque to ordinary heat radiations. Their tests show that it is. It reflects such radiations to only a small extent and absorbs them, changing their energy into heat which finds its way through the glass. Their concluding statement regarding glass follows.

"Glass cannot, within the usual meaning of the term, be considered an insulator for either solar or thermal radiation. It is transparent to the first and depends almost entirely on the resistance of the surface films to retard the transmission of the latter. For this reason double windows are more effective than single windows even though both are equally impervious to air infiltration. Shades and curtains are effective in cold weather because they reduce the radiation loss from a room and its occupants, and may contribute materially to the feeling of comfort at a given temperature by eliminating direct radiation to large glass areas. Solar radiation can be excluded with a coat of whitewash on the outside surface of the glass or preferably by using awnings."

The authors also present the following seven conclusions:

1. Metallic paints absorb more solar radiation than non-metallic paints.
2. For non-metallic paints, white is the best color for preventing the absorption of solar radiation. The order of other colors tested is red, green and black.
3. Weathering and the accumulation of dirt decrease the relative value of white and other light colors.
4. For air velocities greater than about 10 mi. per hr., the importance of surface color decreases.
5. Aluminum paint is not as good as aluminum foil in retarding absorption of solar radiation; both are more effective when applied to an inner surface, facing an air space, rather than on a surface exposed to the sun.
6. Glass is practically transparent to solar energy; the transmission may be reduced with a coat of whitewash or white paint, preferably applied on the outer surface.
7. Glass is practically opaque to low temperature (0–150°) radiations. For radiant energy in this range, glass has an emissivity of about 0.92, hence it is a good absorber and emitter, and heat is transferred through it chiefly by conduction.

Title: Surface Absorption of Heat from Solar Radiation; presented at the A.S.R.E. annual meeting, December, 1932; illustrated with graphs and tables; approximately 2700 words; authors, F. G. Hechler and E. R. Queer.

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1933 Guide Has New Chapters

THE 11th annual (1933) edition of the A.S.H.V.E. Guide appears with a new style cover in striking red. It contains 45 chapters, many of which have been considerably rearranged. New material has been added both under old chapter headings and under a number of new chapter heads. Page size and general style of make-up remain the same but new head type is used.

The material under the general head of air conditioning has geen greatly expanded, and 10 of the chapters now refer to this subject. The method of treatment used is notably different from that followed in earlier editions. More attention has been given to the nature of material included and while the subject is not yet treated with the breadth of view which might be desired, still it does reflect a growing tendency to open up the whole subject to discussion.

For the first time a brief consideration of the subject of radiant heating is included. Unfortunately, the small space devoted to it does not permit getting in more than a rough outline.

Notable is a rearrangement of the heat transmission tables into what should prove a more usable form. These tables have been calculated to take account of latest research findings on the subject. Included, too, are the ventilating standards which were the subject of a long committee study.

This new edition as a whole shows the evident care given to editing. Improvements in this respect should make it more readily usable than were some of the earlier editions.

[*Title: The American Society of Heating and Ventilating Engineers Guide, 1933; 6 in. × 9 in. page size; 592 pages plus catalog data, indexes and membership lists; price, $5.*]

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Effect of Cold Walls Studied at Pittsburgh

THE comfort studies made by the A.S.H.V.E. Laboratory at Pittsburgh have always been conducted in rooms whose wall surfaces were at temperatures at or near the temperature of the air used in the experiments. This is a condition which is approximated in rooms of large area but which is often greatly different from the condition existing in rooms of small dimensions. In such rooms the walls are close enough to the occupants so that their effect on the feeling of comfort may be considerable. The comfort charts built up as a result of these early experiments thus apply directly only to large rooms where wall conditions are not a factor.

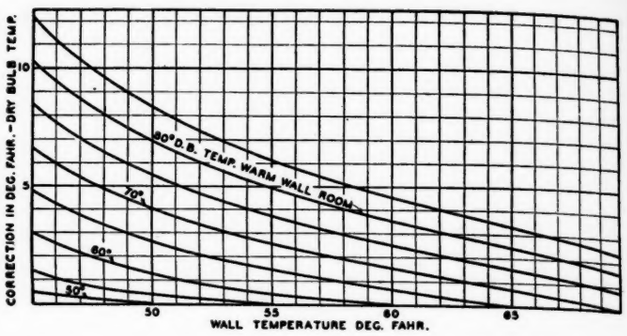
During the past spring and summer some studies were made to find the effect of cold walls on the feeling of comfort, and the results are now available. They show that where there are cold walls the dry bulb temperature must be raised considerably in order to produce the same feeling of comfort as existed when the walls were at air temperature. The increase necessary varies with the temperature of the walls and with the temperature of the room air. This finding corroborates what is predictable by abstract reasoning and the principal result of the experiments reported is a numerical evaluation which is given in the form of two charts one of which is reproduced here.

Granting the correctness and applicability of these figures it will be noted that with a 50° wall temperature and a 70° air temperature in a warm-walled room, a correction of about 4° is shown on the chart. Presumably this would mean keeping the air temperature of a cold-walled room at 74° under these conditions in order to produce a feeling of comfort equal to that felt in a warm-walled room at 70°.

While this chart is interesting its use is open to question because of both its newness and the method used in conducting the studies. On the side of newness, it should be understood that results of applying this rule to actual rooms are not yet available. The testing method is questionable in that the room used was not of conventional or common construction and that only three subjects took part in the studies.

The following conclusions are included at the close of the paper:

"1. Increased radiation of heat from occupants in a room to cold walls on three sides is shown to require a higher air temperature for the same feeling of warmth. For example, an air temperature of 70° with walls at the same temperature is equivalent to an air temperature 8.9° higher in a room having three of the four



Correction to various dry bulb temperatures in a warm wall room for the same feeling of warmth in rooms having three cold walls. Temperatures indicated by plain thermometers, 30 in. above the floor, not in close proximity to occupants.

walls at 45°. This effect is greater than usually occurs in practice for two reasons; *first*, few rooms have three exposed walls, and *second*, inside wall surface temperatures for reasonably good construction do not reach such low values for normal outside temperatures.

2. It is shown that in a cold wall room observed temperatures by mercury thermometers may vary depending on whether the bulb is shielded from or exposed to the *view* of the cold walls and of occupants.

3. Walls of large area having a considerably lower temperature than the surrounding air give a feeling of discomfort to occupants seated nearby due to the resulting feeling of coldness in those parts of the body exposed to the cold walls, even though the room air temperature is high enough to give an over-all sense of not being cold. This is particularly true of large windows without a compensating radiator nearby."

[*Title: "Cold Walls and Their Relation to the Feeling of Warmth," by F. C. Houghten and Paul McDermott. Paper presented at the annual meeting A.S.H.V.E., January, 1933; approximately 4500 words; 3 graphs.*]

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Fifth Bulletin on Warm-Air Heating Now Available

DURING the many years that the warm-air heating studies have been carried on at Illinois the practice of issuing bulletins from time to time has been followed. These bulletins have been not only uniformly exceptional for the clarity with which the results have been presented but they have become virtually the only sources of technical information on warm air. Part V, published under the title "Investigation of Warm-Air Furnaces and Heating Systems," made its appearance recently. It is up to the high standard set by its predecessors, and like them, contains a mass of information.

About the only criticism that can be levelled against this bulletin is the laudable one that the material is so well digested and discussed that it is almost impossible to give an adequate idea of its contents in any briefer form than that used in the bulletin itself. This makes

the task of the reviewer rather hopeless for the bulletin is thick and runs to 155 pages. In the face of this, all that can be attempted is to outline its contents and to touch the high spots. Only a reading of the whole bulletin should satisfy anyone who wishes to follow the work, and such a procedure is recommended.

A list of the chapter headings indicates fairly well the scope of the tests reported and is as follows: Combination Gravity and Fan Furnace Systems; House and Furnace Operation with Conversion Gas Burners; Room Air Temperature Conditions with Warm-Air Registers Located Near Ceiling or Near Floor; Effect of Wind and Sunshine on House Operation; Cooling Effect from Operation of Combination Gravity Fan Furnace System under Summer Conditions; Performance of Steel Furnace with Anthracite and Bituminous Coal; Comparative Study of Types of Furnaces; Effect of Changes in Ratio of Leader Pipe Area to Free Area of Furnace on Plant Performance.

High lights and outstanding quotations as follows:

A. "In combination gravity and fan systems, the capacity of the fan as installed must be greater than the volume of air that would be delivered by the same system operating on gravity at the register air temperature that would be required to heat the building in the most severe weather prevalent in the given locality. Otherwise, the fan system, over the lower range of outdoor temperatures, will operate with higher register air temperatures than would be required by the same system without the fan."

B. "The reduction in fuel cost effected by the use of a fan in a warm-air furnace system may be submerged by the cost of electrical current required to operate the fan."

C. "The introduction of a fan in a well-designed gravity system in which the heat delivered to the different stories is correctly balanced results in unbalancing the heat delivered to the different stories, unless adjustment is made by means of dampers in certain warm-air pipes. Such unbalancing action is manifested as a tendency to overheat the first story and to underheat the second and third stories."

D. (1) "The overall house efficiency is practically the same when the same furnace is installed in a given plant and operated either with a gas conversion burner of the type used or with anthracite coal. (2) High flue gas temperatures and resulting low efficiencies are not necessarily characteristic of a conversion gas burner."

E. A table and curves showing the costs of heating the research residence with bituminous coal, anthracite and gas under Urbana conditions are included.

F. The conclusion that while a saving in fuel consumption of from 4% to 8% was found by reducing the night temperature to 60° instead of keeping it at 70° when firing gas, the practice introduced some penalties in the way of loss of comfort in the house during the morning hours.

G. "The use of ceiling air registers as opposed to baseboard registers offers no advantages in the way of improved temperature conditions in a heated room."

H. (1) "A moderate outdoor temperature accompanied by a strong wind may produce as great a heating load as a materially lower outdoor temperature and a light wind. (2) The use of the 'degree-day' basis only for estimating heating load or comparing the heating seasonal demands of different localities may be seriously in error unless the wind movement is substantially the same for the periods or for the localities compared. The error resulting may be large, amounting to at least 20%, where there is any material difference in the wind movements. (3) Wind movement must be regarded as a very important factor in the design and operation of heating plants. There is a regrettable lack of field data on this subject, and accurate studies using actual buildings subjected to a wide range of wind velocities are greatly needed to overcome our present ignorance of the matter. (4) Serious consideration should be given to sunshine or exposure effects on the heating requirements of rooms subjected to solar radiation, if overheating of such rooms or underheating of rooms not so exposed is to be avoided. (5) Attempts to control the indoor air temperatures of the various rooms of a building from a single point when the sun is shining must prove more or less futile unless the north and south rooms open into each other freely. (6) Heating plant design and operation and control must take into consideration both sun and wind effects as well as temperature differences if satisfactory results are to be secured. (7) The conclusions from the results presented in this entire section may be summarized briefly by saying that heating plant designers and operators have been, and still are, inclined to give too little thought to the effects of exposure (wind and sun) on the heating of buildings. They assume that a plant designed on the basis of temperature differences alone should be adequate to heat the building properly, regardless of the drift of air across the building resulting from the outdoor wind movement or the unbalancing of the heating load caused by solar radiation. Furthermore, the fact that variations in the temperature of the inside surfaces of the walls resulting from variations in wall construction, outdoor temperature, and sun exposure may affect the comfort of the occupants independently of the actual air temperature in the room has not received the recognition it merits."

J. (1) "A furnace fan with capacity sufficient to produce 3.5 recirculations per hour did not produce air velocities at the center of the room to exceed 9 f.p.m. in the rooms of the research residence. (2) The increase in cooling effect and decrease in effective temperatures produced by a furnace fan of reasonable capacity operated under summer conditions is not appreciable, and does not justify the cost of operating such a fan in the summer. (3) No appreciable cooling of the air in the house can be obtained by circulating it through a furnace casing and pipes standing in a relatively cool basement. (4) An appreciable cooling effect may be obtained in the rooms of the house by the use of either an oscillating or a fixed desk fan producing a direct current of air over the occupant of the room."

[*Title: "Investigation of Warm-Air Furnaces and Heating Systems," Part V, Bulletin No. 246, by A. C. Willard, A. P. Kratz, and S. Konzo. Engineering Experiment Station, University of Illinois, Urbana; paper-covered pamphlet; 6 in. × 9 in.; 158 pages; illustrated. Obtainable by addressing Engineering Experiment Station, Urbana, Ill.; price, 80 cents.*]

Your Everyday Problems

HEATING AND VENTILATING will be glad to answer your problems relating to installation and operation of heating and ventilating systems. Letters will be answered promptly, and in some cases published anonymously. If sketches are included they should be clearly drawn. Write The Editor, HEATING AND VENTILATING, 148 Lafayette Street, New York.

QUESTION 73. A customer in whose home we have installed a gas-fired furnace in connection with a gravity warm-air heating system complains that excessive moisture condenses on his windows. The installation was made according to the standard code, and the house is heated satisfactorily with relatively low register temperatures. The building, which is of excellent frame construction, has insulated ceilings, metal weatherstripping at all windows, and heavy felt paper between the boxing and sheeting. No water has been used in the humidifier since the installation of the furnace, and the cellar is dry. By measurement, the humidity in the living rooms ranges between 35% and 40%, and the moisture seems to condense at any outside temperature below 25°. There is one fireplace which has not been used until recently, and since its use, conditions are reported to be somewhat improved.

Please advise us if there is any method of preventing this annoyance other than by putting up storm sash.

X. Co.

ANSWER. At a dry bulb temperature of 70° and a relative humidity of 35%-40% the dew point temperature will be in the neighborhood of 43°, and when the outside temperature falls sufficiently low to cause the temperature of the inside surface of the window glass to reach this point, moisture from the air adjacent to the glass will be condensed on it. Since the humidity conditions you mention as prevailing within the house are approximately correct for comfort and health, the solution of the problem obviously does not lie in reducing this moisture in the air. This would probably be difficult to accomplish anyway, as you state that the furnace humidifier is not in use.

We believe that you have suggested the key to the difficulty in your mention of the fireplace. When the fireplace is in use, heated air and the products of combustion pass up the chimney, and this is replaced by air drawn into the room from outside, largely through the cracks around the windows in spite of the weatherstripping. This incoming outside air would tend to reduce the condensation because its dewpoint temperature is considerably lower than that of the inside air, and the air in the vicinity of the windows is largely made up of this outside air. As a familiar example of the above, consider what happens in a closed automobile when it is driven on a cold day. You have undoubtedly noticed that if you attempt to drive with all windows closed tightly, the glass will rapidly become fogged up. On the other hand, if one or more of the windows be opened even a small crack, the fog will quickly disappear.

We suggest that the weatherstripping be removed from at least some of the windows, perhaps those on the lower floor or in the basement, to permit an increased influx of outside air. A small opening in the supply side of the heater, to permit the mixing of some outside air with the recirculated indoor air, would also help to reduce the humidity in the house. These changes cannot be made, of course, without a loss in heating plant efficiency resulting. More fuel will be consumed in accomplishing the same amount of heating, and it will be advisable to rest with the owner the question as to what extent he is willing to sacrifice economy for the sake of convenience.

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QUESTION 74. I have noted numerous inconsistencies in the use of the term air conditioning. Often a theater, auditorium, or restaurant that is cooled in summer is said to be air conditioned, and again a manufacturer of a heating plant states that his equipment is an "air conditioner." Occasionally, too, I note the term applied to some device which adds moisture to the air, or simply removes dust from it. Can you inform me as to just what the term specifically means?

ANSWER. Confusion certainly does exist as to the true meaning of the term *air conditioning*. We have commented on this before but as the question continues to come up we will try to outline the current ideas more fully than we have before.

Air conditioning involves six functions—warming and humidifying the air in cold weather, cooling and dehumidifying it in warm weather, and circulating and removing impurities from it in all seasons. Heating and cooling may be combined in the single term *temperature maintenance*, while humidifying and dehumidifying can also be shortened into *humidity maintenance*. In the same way circulation and cleaning can be combined in the term *purity maintenance*. On this basis a good general definition of the term *air conditioning* would be, "the artificial adjustment and maintenance of the temperature, humidity, and purity of indoor air to conditions promoting the comfort and health of the occupants." It would also pass muster as a technical definition.

The essential difference of opinion about the use of

the term, and also the one which causes confusion, is whether the definition just mentioned shall be interpreted to mean that all three of the conditions must be adjusted and maintained simultaneously and continuously. One school of opinion holds that they must, and insists that "it isn't air conditioning unless it is complete and continuous." The other holds that adjustment and maintenance of any of the three can be justly considered *air conditioning*, and they so use it. The result is naturally confusion of thought.

Of all the six functions, that of cooling is perhaps the most novel from the popular viewpoint. Also it has been the most widely advertised. There has been a growing tendency to associate it with the term air conditioning.

You ask if we can inform you of the specific meaning of the term. Our answer is that it has no specific meaning at present but has several rather vague meanings. This is quite natural and nothing can be done about it in our opinion. In the long run popular usage is what determines the specific meanings of words. No doubt this will finally fix the meaning of the term air conditioning. In the meantime you are conforming to current good usage if you use it to suit your own ideas. That is what everyone else is doing.

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QUESTION 75. In estimating the amount of radiating surface required to heat a small machine shop, should the heat produced in the electric motors and machines be taken into account? If so, upon what basis should this heat be figured? In the case we have in mind, there are five induction motors driving the machinery through line shafts. These motors total 57.5 *hp., and the foreman reports that they run constantly during working hours.* *B. M. H. Co.*

ANSWER. All of the electrical energy input to an electric motor ultimately manifests itself in the form of sensible heat, and when the mechanical power produced is all utilized within the confines of a single room, we can assume that all of the heat produced is delivered to that room. The quantity of heat resulting from the operation of the motors will be dependent upon the electric power consumption.

Assume then, in the case in hand, that the equipment described is operating at an average of 75% of full load. Also assume that at this rate, the efficiency of the electric motors is 80%. The power input will therefore be equivalent to

$$\frac{57.5 \times 0.75}{0.80} = 53.9 \text{ hp., or } 40.2 \text{ kw.}$$

The heat equivalent of a kilowatt-hour is 3415 B.t.u., so that the heat produced by the operation of the machinery will be $40.2 \times 3415 = 137{,}283$ B.t.u. per hour. This amount of heat may be deducted from that to be supplied by the heating system. It must be borne in mind, however, that this heat is supplied only during the time that the motors are in operation, and adequate provision must be made for heating the shop before working hours in order that it will be warm enough when the operators come to work.

QUESTION 76. Tenants on the lower floors of an apartment house are complaining of odor from the oil burner. The burner is of the gun type, in a cast-iron sectional boiler formerly fired by coal. The odor seems to come up through the dumbwaiter shaft and stair well. The burner is correctly adjusted and burns the oil completely without excessive carbon deposit within the boiler or smoking at the chimney. Can you suggest a cause for my difficulty, and perhaps prescribe a remedy? *C. O. H.*

ANSWER. The products of combustion of some fuel oils often have a slightly perceptible characteristic odor no matter how carefully the equipment be adjusted, and it is necessary to prevent the escape of these odors into the living quarters. This odor will usually be strongest during the starting-up period due to incomplete combustion resulting from the cold combustion chamber and boiler walls.

These odors will not be noticeable in the living quarters if the draft is sufficiently strong to carry them up the chimney and prevent them from leaking out into the cellar. The natural draft will, of course, be poorest during the starting-up time, but if the chimney is correctly proportioned and constructed, and is free and open, gases from within the furnace should not escape into the cellar unless there are excessively large leaks about the boiler setting, furnace doors, flue joints, etc.

We recommend, therefore, that you check the draft and examine the chimney to ascertain that soot or other obstruction is not interfering. We also suggest that smoke-pipe connections, door joints, and boiler setting be examined carefully for leaks and made as tight as possible. If the basement can be ventilated, especially during the starting-up time, it will be found to be helpful in reducing the annoyance.

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QUESTION 77. What effect does painting have upon the heat transmitted by a radiator? Does the color of the paint make any difference in the heat transmitted? *E. J. L.*

ANSWER. The effects of painting upon the transmission of heat from direct radiating surface are nearly totally confined to the radiating factor for that surface, and have little influence upon the convection factor for the radiator. Therefore, the effect of painting radiators having large radiating surfaces, such as wall radiators, pipe coils, etc., will be more marked than that upon column radiators having relatively small radiating surface as compared to convecting surface.

Finely ground paint pigments have been shown to possess approximately the same radiating constant, but metals have a low radiating effect. Therefore, paints made from flaked metal will reduce the radiating effect. Radiators having bare iron surface, or painted a dull black, white enamel, white zinc, etc., will all have approximately the same heating value, while radiators finished with aluminum bronze, gold bronze, etc., will have their heating values reduced an amount ranging between 10% and 20% of that for the bare iron surface, depending upon the type of radiator.

News of the Month

Bill to Authorize Engineers as Agents Again Considered

Licensed professional engineers will be permitted to act as agents for persons desiring permits for construction or alterations under the provisions of a bill to amend the multiple dwellings license law recently re-introduced in the New York State Legislature.

Shaw-Perkins Appoints Fischer

H. L. Fischer, formerly associated with Thos. E. Murray, Inc., and Crane Company, has been appointed district manager of the New York office of the Shaw-Perkins Manufacturing Co., Pittsburgh. Mr. Fischer's offices will be at 55 West 42nd Street.

Electrical Association to Publicise Air Conditioning

As part of its industrial development program, the Electrical Association of New York has established a subcommittee to promote a better public understanding of air conditioning functions and practice. J. J. Donovan, General Electric Company, has been named chairman and the group includes I. W. Baldwin, Westinghouse Electric & Manufacturing Company; A. F. Callahan, Refrigeration Association of New York; C. M. Eakin, Frigidaire Sales Corporation; E. T. Lyle, Carrier Engineering Corporation; C. R. Skinner, New York Edison Company, and A. Sargent, Campbell Metal Window Corporation.

A definite terminology for the science of air conditioning will be proposed by the committee, and educational activities will include extensive advertising campaigns in the metropolitan area by the represented companies.

New Standards for Iron and Steel Wrought Pipe Submitted

In view of important developments made in the art of producing wrought iron and wrought steel pipe during the past 50 years, and to meet the widely different and increasingly severe service conditions, a revision and extension of the standard dimensions originally published in 1886 has been undertaken by the American Standards Association. This organization authorized in 1927 the setting up of a Sectional Committee on the Standardization of Wrought Iron and Wrought Steel Pipe and Tubing at the recommendations of the A.S.M.E. and the A.S.T.M. The first tentative draft of this committee's report has been published for criticism and comment.

Originally these products were formed from skelp heated in a furnace and the edges butt or lap welded. Present practice includes the manufacture of tubing by seamless processes, fusion welding, hammer welding, electric resistance welding, and other special processes, and in addition to wrought iron and mild steel, a wide variety of medium carbon and alloy steels are now available. Formerly fabrication was invariably accomplished by threaded connections, while present practice calls for welding, use of Van Stone joints, and joints similar to Dresser couplings. Furthermore, service conditions have changed from maximum pressures and temperatures of approximately 100 lb. and 250° to pressures of 600 lb. to 1500 lb., at temperatures as high as 1000°.

The new pipe wall thickness schedules were based on the ratio of service pressure to allowable stress intensity for the material, and since the latter is dependent upon the temperature contemplated and the material used, all three variables are considered. It is intended that this standard shall be used in conjunction with the Code for Pressure Piping, now being developed by the same committee.

PACIFIC COAST CHRYSLER PLANT HEATED BY GAS

The new Chrysler motor assembly plant, Los Angeles, with 280,000 sq. ft. of floor space, is said to be one of the largest gas-fired heating installations completed on the Pacific Coast in 1932. The illustration shows two of the 12 batteries, having 10 sections each, of L. J. Mueller gas furnaces.

Eckart Bros. Move

Eckart Bros., Inc., Seattle, Wash., announces the removal of its sales rooms and shop to 2018 Third Ave.

Holmes with Inland Steel Sales

Howard A. Holmes has been appointed to the sales department of the Inland Steel Company, Chicago. He will be located in the Detroit office of the company. Mr. Holmes was formerly with the Weirton Steel Company.

Modernizing Exposition to be Held in New York

Latest trends in building materials and appliances for home and commercial building owners will be displayed at the first National Modern-

ize Your Home Exposition, to be held at Madison Square Garden, New York, March 28-April 1, for the purpose of stimulating replacement business in the building trades. According to the management, modernization work can be done at this time at a great saving to the owner and at the same time will furnish a great measure of relief to unemployed building workers.

York Oil Burner Dealers Meet To Discuss Merchandising

New merchandising and sales promotional plans for 1933 were explained to metropolitan New York dealers by the York Oil Burner Co., Inc., York, Pa., at a meeting held recently by the company at the Hotel New Yorker. Dealers representing 60 localities in New England met February 27 at the Hotel Bradford, Boston, where a similar program was put into effect.

Philadelphia to Have Natural Gas

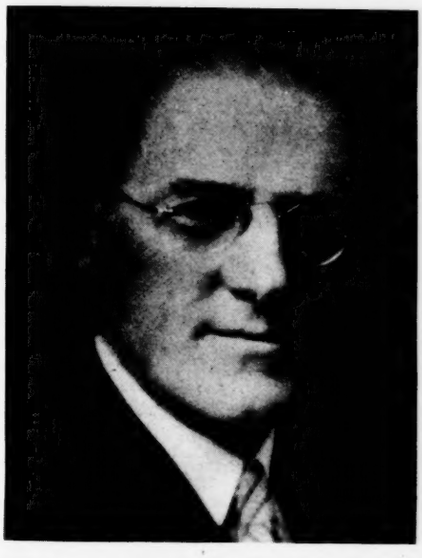
Negotiations for contracts for supplying natural gas to companies providing gas service to a large section of Southeastern Pennsylvania adjacent to Philadelphia are nearly complete with an agreement reported as pending between the Columbia Gas and Electric Corporation, which has three high-pressure pipe lines ready to furnish natural gas to the area, and the United Gas Improvement Company, which controls the gas distributing companies. This development is expected to be followed by extension of the natural gas supply into Philadelphia and also into New Jersey.

A. S. H. V. E. Holds Eventful Annual Meeting in Cincinnati†

The second day of the 39th annual convention of the A.S.H.V.E., held in Cincinnati, January 23-25, opened with a brief report of the Committee on Guide Publication, by D. S. Boyden, chairman.

Following this, F. C. Houghten presented a paper, "Cold Walls and Their Relation to the Feeling of Warmth," by the speaker and Paul McDermott. This was a report of the results of investigations carried out in the society's research laboratory in cooperation with the United States Bureau of Mines to determine quantitative data on the dissipation of heat from the body to surrounding walls at lower temperatures. It was concluded that increased radiation of heat from occupants to cold walls on three sides requires a higher air temperature for the same feeling of warmth.

S. Konzo, research associate, Engineering Experiment Station, University of Illinois, then read a paper, "Study of Summer Cooling in the Research Residence at the University of Illinois," by himself and Prof. A. P. Kratz. This included a description of the house, the method of conducting the tests, and a general presentation of the results obtained. It was stated that the ducts and registers of a central forced-air heating system can be successfully adapted as a distributing system for cooled air in the summertime without material alterations. There was shown to be no tendency for a pool of cold air to collect near the floor if the temperature of the air entering the room through the registers is not lower than 60°, and baseboard registers can be used without objectionable draft if the velocity at the register face does not exceed 300 f.p.m., although wall registers located 7 ft. above the floor are recommended as preferable.



W. T. Jones, inducted into office as president of the A.S.H.V.E. at its 39th annual convention.

A refrigerating load equivalent to 2 tons of ice in 24 hr. may be required in a building of the type of the research residence when the temperature reaches 100° if an effective temperature of approximately 72° is maintained indoors. An effective temperature somewhat higher than 72° may be found satisfactory for residence service, however, in which case, greater economy can be achieved. Use of awnings on all east, west, and south windows may result in savings of from 20% to 30% in cooling load. The cooling load per degree difference in indoor and outdoor temperature has been shown to be not constant, but increasing as the outdoor temperature increases. The results of the experiments suggested the need for further investigations to study the load requirements when unit coolers are used in one or more partially isolated rooms with the balance of the building uncooled, and also to determine the possibilities of the use of a fan at night to provide more comfortable conditions on the following day without a cooling system, or to reduce the load on the cooling system.

The next paper was entitled "Summer Cooling Operating Results in a Detroit Residence," by J. H. Walker and G. B. Helmrich, both of The Detroit Edison Company. This paper, read by Mr. Walker, gave the results obtained from the study of a residence cooling system under normal conditions of occupancy and with only a moderate degree of cooling, as compared with the conditions maintained in the research residence at the University of Illinois. The work as undertaken by The Detroit Edison Company was intended to determine the minimum requirements for producing a moderate improvement with small investment.

†The report of the first day's meeting of the convention was published in the February, 1933, issue of HEATING AND VENTILATING, pages 54-55.

News of the Month

During the early part of the summer, the system was operated freely without regard for economy, and ice consumption on days when the outdoor temperature reached 95° varied from 1000 lb. to 2500 lb. to maintain indoor temperatures of 75° to 77°. During the month of August a more moderate degree of cooling was maintained and ice consumption reduced to 500 lb. to 700 lb. per day. These experiments demonstrated that in a well shaded and insulated house, in a climate such as that prevailing in Detroit, Mich., summer cooling with ice is economically feasible provided a moderate amount of cooling is done. The findings reported in the previous paper with regard to the adaptability of a well designed warm-air heating plant to summer cooling is borne out. Use of outside air at such times as its temperature is below the inside temperature is desirable but does not by itself give adequate comfort in extremely hot weather.

In the succeeding discussion, E. K. Campbell, Kansas City, Mo., stated that in his experience a much larger fan is needed for circulation in cooling systems than is generally specified, and that the fan should have two operating speeds.

The afternoon session opened with a report of the Committee on Chapter Relations, delivered by Mr. Campbell. The work of the committee was briefly outlined and mention was made of the advantages to be had from joint chapter meetings.

"Corrosion in Air Conditioning Equipment and its Prevention" was then presented by its author, R. M. Palmer, New York. This paper points out that characteristics of water supplied from the usual municipal source vary to a wide extent, and that certain waters are corrosive while others are scale forming, due to dissolved solid matter or hydrogen ion concentration. Water that has been used for a considerable length of time in conditioning apparatus invariably contains more dissolved solids and a greater hydrogen ion concentration than new water. These conditions often bring about a high rate of depreciation of the apparatus and lowered operating efficiencies. It is shown that chemical analyses of waters followed by corrective chemical treatment will obviate many of the difficulties encountered and prolong the life of the equipment.

A report of the advisory council on the proposed revisions of the by-laws as held over from the preceding day followed. A motion was made and adopted, subject to vote by the entire membership, to reduce the dues for 1933-1934 to $18 for regular members, and to give the Council power to maintain this schedule during the two year period, and to change the amount during that time if it should become advisable. Dues are to be $25 in 1935, but the Council is empowered to extend or change dues at the end of 1934 in accordance to conditions prevailing at that time.

After considerable discussion a motion was proposed and adopted that the present procedure followed by the nominating committee in the selection of officers be continued, with the exception that no votes may be cast by proxy. Final acceptance of this provision rests with a general vote of the membership.

"Cow Barn Ventilation," a paper by Alfred J. Offner, New York, followed. This explained the need for ventilation, and various methods were described. The amounts of ventilation for various sizes of barns are given for the several dairy zones in the United States.

In concluding the afternoon program, Paul D. Close abstracted the paper "Air Infiltration Through Steel Framed Windows," by D. O. Rusk, V. H. Cherry, and L. Boelter, of the faculty of the College of Engineering, University of California, Berkeley. It was pointed out that a wide variation in amount of infiltration may be expected for different types of window construction. Infiltration was shown to take place at a greater rate when the air is dry. Recommendations for tests on windows were made.

Two papers, "Flow of Condensate and Air in Steam Heating Returns," by F. C. Houghten and Carl Gutberlet, and "Condensate and Air Return in Steam Heating Systems," by F. C. Houghten and J. L. Blackshaw, were read by Mr. Blackshaw at the opening of the final session of the meeting. In the first of these it was shown that the leakage of air into piping systems under vaccuum varies widely with the different set-ups studied, becoming greater as the number of fittings and valves around radiator connections increases. The total leakage, however, even with higher vacuums than are customarily used in practice applied uniformly throughout the system, corresponds to comparatively small rates of air flow during normal operation of the system. Greater rates of water delivery were found for a given pressure drop than would be given by the usual hydraulic formula and accepted constants. Corrected constants giving flows equal to that observed are presented.

The pressure-drop-flow relation is given for different ratios of air and water flowing in 1 in., 1½ in., and 2 in. pipe, when operating as a dry return main. A formula is developed giving the capacities of pipe for carrying condensate and air based upon the diameter of the pipe, the pressure drop, and the ratio of air to condensate carried.

In the second of these papers, it is recommended that return pipe sizes for vacuum systems be based upon a maximum condensation load during the heating-up period of

COMING EVENTS

MARCH 28-APRIL 1, 1933. First National Modernize Your Home Exposition, to be held at Madison Square Garden, New York. Headquarters at the Waldorf-Astoria Hotel, New York.

JUNE 12-17, 1933. Tenth Annual Convention of the American Oil Burner Association, to be held in Chicago. Headquarters at the Hotel Stevens.

JUNE 19-22, 1933. Fifty-First Annual Convention and Exposition of the National Association of Master Plumbers, to be held in New Orleans, La.

JUNE 25-30, 1933. Sixth Midwest Engineering and Power Exposition, to be held in Chicago.

JUNE 27-30, 1933. Twenty-Fourth Annual Convention of the National District Heating Association, to be held in Chicago. Headquarters at the Palmer House.

JULY 25-28, 1933. Annual Convention of the Heating and Piping Contractors National Association, to be held in Chicago.

SEPTEMBER 25-29, 1933. Fifteenth Annual Convention of the American Gas Association, to be held in Chicago.

150% of the designed condensation load under standard conditions, and a ratio of 0.10 cu. ft. of air per pound of condensate, allowing possibly a slightly smaller ratio of air for systems containing radiation with small volumetric capacity and a slightly higher ratio for systems containing radiation with large volumetric capacity. Return pipe sizes in gravity systems should allow a larger factor of safety, and hence it is recommended that they be based on 175% of the designed condensation load under standard conditions, and a ratio of 0.15 cu. ft. of air per pound of condensate.

C. V. Haynes opened the discussion by asking whether the new values were found to be at variance with the data published in the *Guide*, to which Mr. Houghten replied in the affirmative, adding that the findings of these tests will be of value to the Committee on Pipe Sizes when next revising the tables for return pipe lines. Mr. Haynes proposed that the authors of the two papers confer with the Technical Committee on Pipe Sizes and prepare complete data. Mr. Houghten replied that such a plan is under way and complete information will be published in the next issue of the *Guide*.

The new officers of the society were then formally inducted. W. T. Jones took the chair as president, and C. V. Haynes, John Howatt, and D. S. Boyden were installed as first vice-president, second vice-president, and treasurer, respectively. The new councilmen are L. W. Moon, J. D. Cassel, R. H. Carpenter, and J. F. McIntire.

Mr. Driscoll opened the new business session with a motion that the new president appoint a committee to decide upon a suitable term to replace the present term "square foot" to represent a unit of radiation. The motion was carried. It was resolved to send a letter of sympathy to Andrew C. Edgar, Philadelphia, charter member of the society, who was taken ill on the first day of the meeting and forced to return to his home, and who has never missed an annual meeting. Mr. Edgar since passed away. The report of the Resolutions Committee concluded the business and the meeting was adjourned.

Building Permits Show Gain in January

Total expenditures for building operations including alterations and repairs indicated by building permits issued during January, 1933, amounted to $42.8 million, an increase of 39.6% over expenditures indicated for December, 1932, according to the Bureau of Labor Statistics of the Department of Labor. Comparing the two months, there was an increase for January of 2.7% in number but a decrease of 6.3% in expenditures for new residential buildings. New nonresidential buildings showed an increase of 3.9% in number and an increase of 55% in indicated expenditure. An increase of 10.1% in number and 18.2% in indicated cost for additions, alterations, and repairs was noted for January over the preceding month.

Fuel Oil May be Supplied Through Mains

Oil burners installed in homes on a rental basis and supplied with metered oil from street service mains is a plan proposed for several towns on Long Island's south shore by the South Shore Heating Company, which has applied to the village of Babylon, N. Y., for franchise. A similar proposal was brought forward in November, 1931, but was not carried through at that time. It is stated that the company has the support of leading manufacturers of oil-burning equipment, and that no public financing will be needed to launch the project.

News of the Month

Webb New Superstat Sales Manager

John S. Webb, formerly connected with the Webster Tallmadge Company, is now sales manager of the Superstat Co., 38 Walter St., Springfield, Mass.

Frigidaire Sponsors Air Conditioning School

With more than 125 representatives of public utilities, furnace manufacturers, and air conditioning sales managers and engineers from Frigidaire dustributing and district headquarters in attendance, a five-day school in air conditioning was held in Dayton, Ohio, February 6-10, sponsored by Frigidaire Corporation. Instruction was under the direction of J. C. Chambers, manager of Frigidaire's air conditioning

STUDENTS ATTENDING FRIGIDAIRE'S AIR CONDITIONING SCHOOL

A few of the heating equipment men who attended the company's first domestic and commercial air conditioning school, February 6-10. Front row, left to right, G. W. Summers, St. Louis, O. S. Humphrey, Memphis; H. V. McKee, Indianapolis; H. P. Mueller, Milwaukee, and J. C. Chambers, manager of the Frigidaire air conditioning division. Rear row, left to right, R. M. Roseborough, St. Louis; C. L. Hewitt, Jr., Baltimore; C. G. Abbott, Springfield, Ohio, and Roy Moffitt, Chicago.

division, who stated that the purpose of the school was to give to men who will be actively engaged in selling and installing air conditioning equipment a basic knowledge of the development of means for human comfort and efficiency as well as the many applications which may be made with equipment available today.

Mr. Chambers' staff of instructors included L. E. Smith, George S. Jones, Jr., and other engineering and research division members of the company.

Michigan State to Hold Second Warm-Air Course

A second short course in forced warm-air heating has been scheduled for March 28-30 by the Engineering Department, Michigan State College, Lansing. It is intended to enable dealers and others engaged in the industry properly to calculate and engineer forced air systems, and attention will be given to controls and similar accessories. Registration fee is $3, which includes the banquet. The tentative program follows:

March 28

9:00 a.m.—Estimating Heat Losses and Discussion of Troubles.
1:30 p.m.—Estimating Duct Sizes. Discussion—Register Temperatures, Troubles.
7:30 p.m.—Laboratory Demonstrations.

March 29

9:30 a.m.—Fan Characteristics and Pressure Losses, Filters, Washers, etc.
1:30 p.m.—Furnace Controls—Coal-fired, Gas, or Oil-fired.
Discussion of Furnace Sizes.
6:30 p.m.—Banquet.

March 30

8:00 a.m.—Humidification and the Comfort Zone.
Types of Equipment.
1:30 p.m.—Heat Removal in Cooling.

New York Section of A. S. R. E. Hears Talk on Appraisals

The 40 members who attended the meeting of the New York Section of the A.S.R.E. at the Hotel McAlpin, January 26, were privileged to listen to a most unusual talk by Lyle H. Olson, vice-president, American Appraisal Co., New York. Mr. Olson spoke from the many years of experience which his company has had in appraising refrigerating properties, and presented some most interesting statistics. He also discussed the problems of appraising physical assets which have been brought about by rapid changes in reproduction values in recent years, and also by the rapid obsolescence of plants through technical development.

In the absence of C. H. Launspach, Vilter Manufacturing Co., Milwaukee, who was unable to be present to deliver his scheduled talk on "Industrial Refrigeration," Harry Harrison, of the Brunswick-Kroeschell Division, Carrier Corporation, who acted as chairman of the meeting, summarized briefly the paper "Cold Diffusion in Commercial Applications," which he presented in full before the annual meeting in December.

Raisler to Distribute Electrol

Raisler Engineering Co., Inc., New York, merchandising subsidiary of Raisler Heating Company, has been appointed distributor for Electrol oil burners in the New York area. The company plans to expand its merchandising activities to include air conditioning and will work with heating contractors in its territory to sell automatic heat and air conditioning equipment. T. G. Walker, formerly of Electrol, Inc., Boston branch, will be in charge of sales.

250 Western Engineers Convene for Air Conditioning Symposium

With some 250 west coast engineers in attendance, the Western Conference on Air Conditioning, sponsored by the San Francisco Section, A.S.M.E., was held in Berkeley, Calif., February 9-10. L. Washington, of Stanford University, opened the business with a discussion, "Basic Theory of Air Conditioning," illustrated with black-board demonstrations. This was followed by a description of the psychrometric chart and its uses, by C. R. Dodson, of the University of California.

Effects of the condition of the air on comfort and efficiency were discussed by C. W. Brown, assistant professor of psychology, at the University of California, in a paper entitled "Physiological-Psychological Basis of Comfort." An analysis of cooling fundamentals followed, presented by Prof. Walter S. Weeks, of the University of California. "Insulation and Heat Capacity in Relation to Heat Transfer" was then presented by Prof. L. M. K. Boelter, of the University of California.

Experiences of the Fox West Coast Theaters with air conditioning plants in its amusement houses were related by Lee Hungerford, chief engineer. H. L. Lincoln, of the Union Ice Company, next addressed the group on "Cooling with Ice in California Valley Summer Weather," in which practical aspects of the subject were covered.

At the dinner meeting held at the Engineers Club, San Francisco, Dr. Albert H. Howe, specialist in respiratory diseases, spoke on "Medical Aspects of Air Conditioning."

"Design Procedure for Heating and Cooling Installations," by W. E. Leland, opened the Friday session, followed by F. W. Kolb who discussed air filtration. J. J. Donovan then spoke on "The Architect's Problems in Heating, Cooling, and Ventilating," in which he discussed collaboration between the architect and the engineer, picturing both as trouble shooters before trouble commences. "Control and Regulation" was then discussed by T. B. Hunter, followed by B. M. Woods, who with associates at the University of California, had prepared a paper on "Cooling Rural Homes—A Study in Progress." L. M. K. Boelter and Virgil H. Cherry presented the concluding paper, "Air Infiltration Through Windows."

Delco Heat Joins A.O.B.A.

Delco Appliance Corp., Rochester, N. Y., subsidiary of General Motors Corporation, which has completed arrangements for national distribution of its line of oil burners, has become affiliated with the American Oil Burner Association.

Timmis and Kingsland Talk on Temperature Controls

W. Walter Timmis, New York manager of C. A. Dunham Company, and George D. Kingsland, vice-president, Minneapolis-Honeywell Regulator Company, were the speakers at the regular meeting of the New York chapter of the A.S.H.V.E., February 20. Mr. Timmis spoke on what might be termed central temperature controls, by means of which the steam is controlled in the piping, giving control over zones in the building, while Mr. Kingsland's subject was individual radiator control valves.

Mr. Timmis pointed out that one of the advantages of the zone control was that it greatly cut down on the heat loss from piping which, if not so controlled, would at all times be under steam pressure, while if under control would be cold when heat was not being supplied to the radiator. The speaker discussed vacuum return line systems and zone control, and showed numerous examples of such installations.

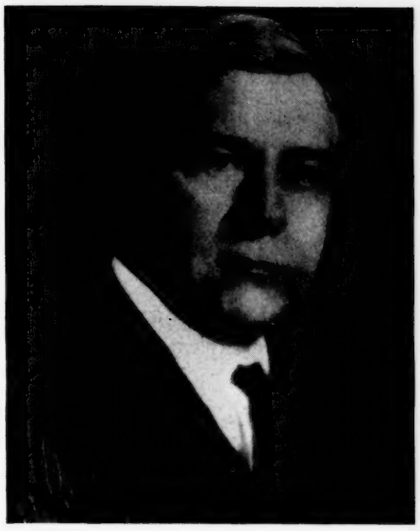
An unusual presentation of his subject was used by Mr. Kingsland, who told about radiator control valves by following the progressive steps made by his company in developing this line of equipment. A complete series of models was mounted in view of the audience and by means of slides the speaker showed the results obtained by each model, and the improvements felt necessary, concluding with the model now being made.

The resignation of L. T. M. Ralston as president of the chapter was accepted, the resignation being offered due to Mr. Ralston's illness.

Andrew Clinton Edgar

Andrew C. Edgar, only member of the A.S.H.V.E. who attended every annual meeting of the society, died on February 13 of angina pectoris. He was taken suddenly ill in the Hotel Gibson, Cincinnati, while attending the 39th annual meeting of the society.

Born on November 28, 1869, Mr. Edgar had been connected with the Pierce, Butler & Pierce Manufacturing Corporation, and the Abram Cox Stove Company. For 12 years



Andrew C. Edgar

he was engaged in the heating contracting business in Philadelphia. He was active in the affairs of the National Association of Warm Air Furnace Manufacturers, Certified Heating Association, Philadelphia Heating and Plumbing Contractors Association, Heating and Piping Contractors Association and the United Association of Journeymen Plumbers and Steamfitters. He was a charter and life member of the A.S.H.V.E.

Mr. Edgar is survived by four daughters and two sons.

Early Curb on Bid Shopping Expected

Although the Goss bill, providing legislation against the practice of peddling subcontractor bids on Federal-financed building operations, was defeated in the present session of the House of Representatives, an early passage of some law to prevent bid shopping in Government work is hoped for by the building industry. James A. Wetmore, acting supervising architect of the Treasury Department, stated that the Treasury recognizes the evils of bid shopping and agrees that it should be curbed in some way, but does not believe that this would be possible under the provisions of the present bill.

Opportunities for evasion of the law allowed by the bill in its present form are given as cause for the Treasury Department's opposition to it. Under the Goss bill, as proposed, a contractor, not knowing who his subcontractors would be, could write in his own name as indicating his intention to do certain parts of the work, later to request permission to let it out as a subcontract when it became evident that he himself could not advantageously do it.

Detroit Utility Plans Air Conditioning Promotion Campaign

A conference on air conditioning was held in Detroit, January 31, under the auspices of the Detroit Edison Company, at which more than 400 engineers and contractors heard described new developments in comfort cooling equipment and practice, and learned of plans for a direct mail advertising campaign to be carried on to stimulate interest in air conditioning and comfort cooling.

S. S. Sanford, of the utility's power sales department, provided a number of suggestions for selling equipment in which he compared the ice cooling system with the mechanical system as to fixed and operating costs, and strongly advocated that the salesman determine as soon as possible his prospect's ability to buy to enable him to recommend the most suitable equipment. J. H. Walker, superintendent of central heating, and G. B. Helmrich, engineering department, Detroit Edison Company, followed with descriptions and general specifications of the various types of equipment.

For the advertising campaign, to be conducted during the spring and summer, the equipment contractors will submit lists of prospects, together with their own letterheads, to the Detroit Edison Company, which will prepare and send out the mailing pieces. The contractor is then expected to follow up the prospect.

British Heating Engineers to Publish Own Journal

The Institution of Heating and Ventilating Engineers, 12 Russell Square, London, W.C. 1, England,

News of the Month

has announced that it will commence independent publication of a Journal for its members at an early date. Editorial offices will be located at 43 Belvedere Road, London, S.E. 1.

Waddell in Charge of Spencer Sales in West

J. A. Waddell, who has been chief engineer of the Spencer Heater Co., Williamsport, Pa., for the past seven years, has been put in charge of the company's sales development in the middle west.

W. S. Anderson, Jr., formerly connected wth the Riley Stoker Co., Springfield, Mass., and the Bigelow Co., New Haven, Conn., has been appointed sales engineer for the company, with headquarters at Williamsport.

R. J. Schwab Sons Co. Organized

Henry E. and Charles E. Schwab have organized the R. J. Schwab Sons Company to continue the business formerly carried on by R. J. Schwab & Sons Company. The latter company was established in 1876 by R. J. Schwab, who has since retired.

Henry E. Schwab will be president of the new company and Charles E. Schwab vice-president and secretary. The new company will continue the manufacture and sale of heating equipment and will extend its efforts into the air conditioning field and allied products.

Charles C. Ramsdell

Charles C. Ramsdell, president of the Gilbert & Barker Manufacturing Co., West Springfield, Mass., prior to his retirement last year, died on February 8 at the age of 63 after an illness of several weeks. He had been suffering from heart trouble.

Barron Joins J. French Paddock Organization

Allen W. Barron, mechanical and electrical engineer, formerly a member of the firm of VanTuyl, Heartt & Barron, has joined the organization of J. French Paddock & Associates, 305 Stormfeltz-Loveley Building, Detroit, as consulting associate. Mr. Barron will specialize in air conditioning, heating, ventilating, industrial and power plant design.

Methyl Formate Included in New Refrigeration Safety Code

A revision of the Safety Code for Mechanical Refrigeration, made in order to bring the refrigerant methyl formate within the provisions of the code, has been approved by the American Standards Association. Copies of the revised code are available at 30 cents each from the association, 29 West 39th St., New York.

Kieley & Mueller Appoints United Equipment and Bollenbacher

Kieley & Mueller, Inc., 34 West 13th St., New York, has appointed United Equipment Corp., 245 South Third St., Columbus, Ohio, as its representative in the state of Ohio, exclusive of Cleveland, Eastern Kentucky and the western part of West Virginia.

E. H. Bollenbacher, Atlanta, Ga., has been appointed the company's representative in Georgia, Florida, Alabama and Eastern Tennessee.

Early Enthusiasm Shown for Oil Burner Show

Forty-seven manufacturers have arranged for 77 exhibition spaces at the Tenth National Oil Burner Show of the American Oil Burner Association, to be held at the Stevens Hotel, Chicago, June 12-16. This is the most enthusiastic response to a national convention shown in the 10 years of the association's history, according to Harry F. Tapp, executive secretary.

New Catalogs

Air Reduction Sales Co., 60 East 42nd St., New York, has issued a booklet entitled "Piping Tailored To Fit," in which economies and advantages of oxy-acetylene welding in the piping field are discussed. Illustrated with installation photographs and drawings showing proper methods; 26 pages, 6 in. × 9 in.

The Atlas Valve Co., 282 South St., Newark, N. J., has issued a data and price book on the Victor temperature regulator. The regulators are described, and applications illustrated.

Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh, Pa., has issued Bulletins 1320, 1321, and 1324, describing Bacharach direct-reading manometers of both the vertical and the inclined tube type; standard size, 13 pages.

Carrick Engineering Co., Michigan City, Ind., has issued catalog No. 100 describing Carrick furnace draft regulators; standard size, 12 pages. A second bulletin, "High Buildings with Low Fuel Bills," published by the same company, discusses increased efficiencies in tall building heating plants resulting from furnace draft regulation; standard size, 8 pages.

Eureka Valve Division of The Ohio Pattern Works & Foundry Co., Cincinnati, has issued catalog No. 30 describing valves and fittings for heating systems. New announcements include an angle valve, horizontal and angle check valves, packless radiator valves, and several new types of radiator valve; 31 pages, 5¼ in. x 7¾ in.

The Ideal Electric and Manufacturing Co., Mansfield, Ohio, has issued Bulletin 540, describing and giving engineering data for Self-Syn synchronous motors; standard size.

Owens-Illinois Glass Co., Toledo, Ohio, has issued a bulletin describing Dustop viscous-coated glass wool air filters. Various installation arrangements are suggested, and capacity data included; standard size, 16 pages.

Pittsburgh Equitable Meter Co., 400 North Lexington Ave., Pittsburgh, has issued Bulletin 1007, describing Emco gas appliance regulators for controlling the burner pressure on gas-fired equipment. A new line of water regulators and strainers for air conditioning apparatus is included; standard size.

New Equipment

Stretch-Proof Rubber Fabric Belts

L. H. Gilmer Co., Tacony, Philadelphia, is manufacturing Gilmer endless Kable Kord transmission belts in sizes and types for all flat drives from light high-speed service to heavy duty loads such as compressors, reciprocating pumps, and large engine drives.

These belts are said to combine the functions of a power belt and an external contactor belt. Kable Kord belts are built around two layers of cords. Those of the outer layer have practically no stretch, and their purpose is to squeeze the pulling element against the pulleys, preventing creep and slipping. Load-carrying cords are arranged in a layer nearer the inside surface of the belt, and both layers of cords are imbedded in tough pliable rubber. An outer jacket of heavy fabric encloses and protects the whole.

Required center distances are reduced, according to the manufacturer, because the flexibility and resistance to stretch of this belting gives it effective grip and pull over pulleys of smaller diameter. There is no splicing to weaken the load-carrying cords and cause noise and vibration, and the belting is said to be immune to glazing which causes slip and wear. Roll belting, round belting, and V-belting are also sold by this company.

Vacuum Form Removes Air and Condensate from Steam System

United States Radiator Corp., Detroit, is distributing the Vacuum Form, a device for relieving air and returning condensation to the boiler in low-pressure heating systems, manufactured by D & T Manufacturing Co., St. Louis. The manufacturer states that this device performs the functions of a vacuum pump, a condensation pump, and a receiving tank, by utilizing a differential of pressure resulting from condensation of steam rather than by mechanical pumping.

The first steam generated in the boiler passes into the condensing chamber of the Vacuum Form and forces the air contained in this space out through an automatic air vent. As the condensing chamber fills with live steam, the temperature increases, expanding a volatile-filled regulating bellows which closes the steam valve and by the same action opens a damper which admits cold air. This cold air is drawn in by an induced draft as the whole apparatus is connected to the boiler flue.

This air serves as the cooling medium which, in passing around the outer shell of the condenser and through the flues within the device, condenses the steam and induces a vacuum of from 2 in. to 10 in. in the condensing chamber. Air and condensation are removed from the heating system to displace the condensed steam, and the cold air acts to reverse the operation of the regulating bellows to open the steam valve and close the cold air damper. The incoming steam discharges the air into the atmosphere, and the water is returned to the boiler.

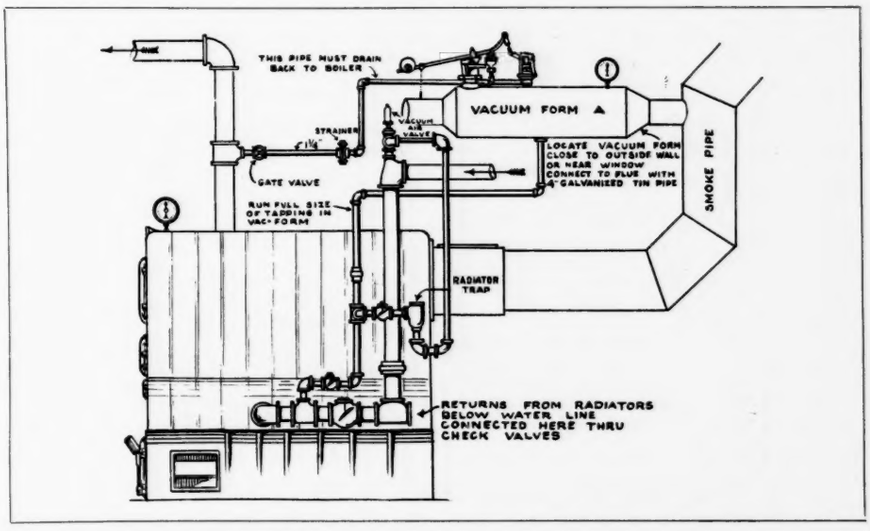
This device can be applied to the two-pipe gravity system, the one-pipe gravity system, the air-line system, or the vapor vacuum system, Type A being adapted to the first three systems mentioned, and the Type W, a slightly modified form, incorporating a boiler return trap, to the latter.

Vacuum Pump Meters Steam

A vacuum condensation pump of unusual design which meters the steam used in the system is being marketed by O. Glystrom Co., 108 West Wells St., Milwaukee, Wis.

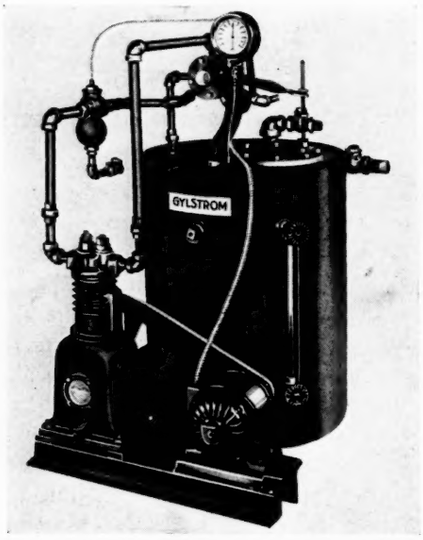
Condensation enters the receiver to replace the air exhausted from it by the pump which handles only air and operates alternately as a dry vacuum pump and an air compressor, depending upon the position of the float-controlled distributing valve. When the water level in the receiver reaches the proper level, the distributing valve is thrown to the discharge position and the air pump discharges to the tank to build up sufficient pressure to return the water to the boiler. When the water level has fallen in the receiver, the float shifts the valve back to the original position, and air is again withdrawn from the receiver and discharged into the atmosphere.

Pump is motor-driven through two or more V-belts, and is fitted with wear and corrosion-resisting valves. A small separator removes any condensation that may accompany the air from the receiver. Electrical connections between the switch and motor are made at the factory, and the automatic control, consisting of a combination of vacuum and float snap switches,


THIS PIPE MUST DRAIN BACK TO BOILER
VACUUM FORM
STRAINER
VACUUM AIR VALVE
LOCATE VACUUM FORM CLOSE TO OUTSIDE WALL OR NEAR WINDOW CONNECT TO FLUE WITH 4" GALVANIZED TIN PIPE
SMOKE PIPE
GATE VALVE
RUN FULL SIZE OF TAPPING IN VAC-FORM
RADIATOR TRAP
RETURNS FROM RADIATORS BELOW WATER LINE CONNECTED HERE THRU CHECK VALVES

Application of Vacuum Form to one-pipe gravity system

New Equipment



Glystrom vacuum condensation pump

permitting operation as a vacuum pump or as a plain return pump, is included. Receivers are calibrated at the factory, and since a definite quantity of water is discharged for each cycle, the quantity of steam passed through the system during any given period can be metered by referring the index number provided to the stroke counter included with the machine.

Standard pumps range in capacity from 5000 sq. ft. to 50,000 sq. ft. of steam radiating surface, with corresponding air capacities ranging between 4 c.f.m. and 27 c.f.m. These units can deliver against a pressure of 25 lb. per sq. in., and will be supplied for higher pressures where required.

Automatic Primer for Centrifugal Pumps

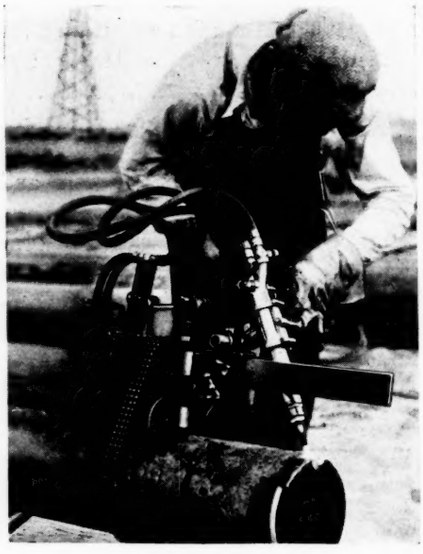
An automatic primer for attachment to a centrifugal pump to maintain it ready for instant use at all times has been developed by Skidmore Corp., St. Joseph, Mich.

This device, which is mounted on the pump suction line, consists of a float chamber which regulates the water level and serves as a trap for air. Control mechanism may be either electrically or water-pressure operated. A vacuum-producing device, which may be a small vacuum pump or a jet vacuum producer connected to water under pressure, applies a reduced pressure to the float chamber causing the water within it to rise, displacing the air in the centrifugal pump. An equalizing pipe, connecting the pump casing surrounding the eye with the top of the float chamber, permits this water to rise to a sufficiently high level to maintain the prime in the pump. The vacuum producer is shut off as the float reaches the top of the chamber.

If it is impractical to use water jet to produce the vacuum, a small electrically-driven vacuum pump is supplied.

Machine Cuts and Bevels Pipe on Job

Air Reduction Sales Co., 60 East 42nd St., New York, has announced the Airco pipe cutting and beveling machine for performing these operations rapidly and with mechanical accuracy on the job or in the shop.



Airco pipe cutter and beveler in use

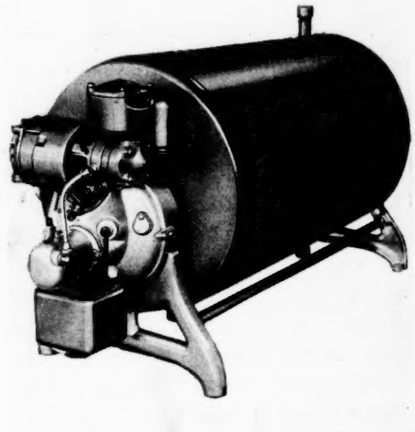
A chain of correct length for 12-in. pipe and having detachable slip links for fitting to 4 in., 6 in., 8 in., and 10-in. pipe tightens the machine to the pipe. The torch is then set and clamped in position for the desired cut or bevel, and the operator moves the device around the pipe by turning a crank which rotates a sprocket along the chain. The machine travels around the surface of the pipe on rollers, cutting the ends square with the pipe axis. Branch fittings can also be cut and beveled for welding with this apparatus, and a complete section of pipe, including a faulty weld or leaking screwed coupling can be cut out of the line in one operation, if two torches are used in the machine. Additional chains are available, adapting the machine to pipe up to 18 in. in diameter.

Oil-Burning Water Heating Unit Has Horizontal Tank

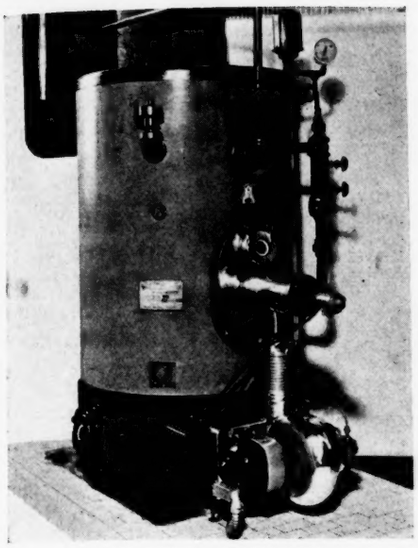
A domestic water heating unit of unique design, having a horizontal water chamber, has been introduced by the Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Fired by a Williams Oil-O-Matic burner, combustion takes place in a central cylindrical chamber extending through the length of the horizontal tank. This tank is divided into four longitudinal passages by a heavy block of refractory material which absorbs heat and transfers it to the surrounding water surfaces. The hot gases of combustion make three complete longitudinal passes through this water-surrounded combustion chamber before entering the chimney flue, and the design is such, according to the manufacturer, that it has been possible to adjust the temperature of the flue gases to a point just above the condensation temperature, the practical limit of heat extraction.

Operation is intermittent, the oil burner being switched on and off automatically by a thermostat immersed directly in the water. The thermostat may be set for any temperature between 140° and 200°. The burner, when operating, consumes ½ gal. of oil per hour. Exceedingly compact, the unit is 55½ in. long, 22⅜ in. wide, and 27 in. high.



Williams Oil-O-Matic water heater



Wayne boiler-burner combination

Wayne and Bass Build Boiler-Burner Unit

A combined oil burner and boiler unit has been announced by the Wayne Oil Burner Corp., Fort Wayne, Ind. The boiler is the Bass 90, manufactured by the Bass Foundry & Machine Co., Fort Wayne, described in the September, 1932, issue of HEATING AND VENTILATING.

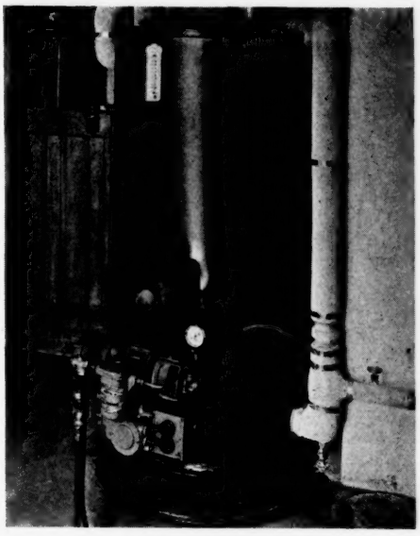
Matched to this is a Model S-4 Wayne oil burner, having fan, oil pump, and Leland repulsion-induction motor mounted on a single shaft. A new type of combustion tube and nozzle shut-off is incorporated, and Minneapolis-Honeywell controls are included. Burner base, fan housing, and combustion tube are chromium-plated. Three sizes of boiler are made, for 700 sq. ft., 1300 sq. ft., and 2100 sq. ft. of steam radiation, and one size of burner, adjusted to burn 1½ gal., 2½ gal., and 4½ gal. of No. 3 oil per hour respectively, is used for all three sizes of boiler.

Boiler-Burner Unit for Heating or Hot Water Supply

A combined boiler-burner unit, described as the Aristocrat oil-fired water heater and residence heating boiler, has been announced by Combustion Oil Burner Co., Division of The Heil Co., 3000 West Montana St., Milwaukee. It can be installed as a steam or hot water boiler for house-heating service, or as a water heater for apartments, hotels, schools, and similar establishments requiring moderately large volumes of hot water.

Unit is of welded steel construction, round in cross section, and having 18 seamless steel vertical welded-in fire tubes. The gun-type burner is mounted eccentrically to give the gases of combustion a swirling motion as they travel upward in the long central combustion chamber before they pass down through the tubes and out at the base. Full automatic controls start and stop the burner to maintain the required temperature. The boiler is insulated and covered with an attractively finished metal outer jacket.

Heater has a capacity for heating 300 gal. of water per hour, calculated on an 80° rise in temperature, which is said to be equivalent to 750 sq. ft. of direct steam radiation, or 1200 sq. ft. of hot water radiation. The burner consumes 1.65 gal. of oil per hour at this output.



Aristocrat boiler-burner

Sheer Announces Portable Humidifier

H. M. Sheer Co., Quincy, Ill., has announced the Pep-Aire portable electric humidifier. Driven by an adjustable speed squirrel cage type motor, the unit draws air in from the room by the action of spinner tubes rotating like a turbine. This air is passed down through the motor support sleeve to the spray chamber where it traverses a circular path about 14 ft. in length before being projected into the room. Dust is washed from the air in the spray chamber.

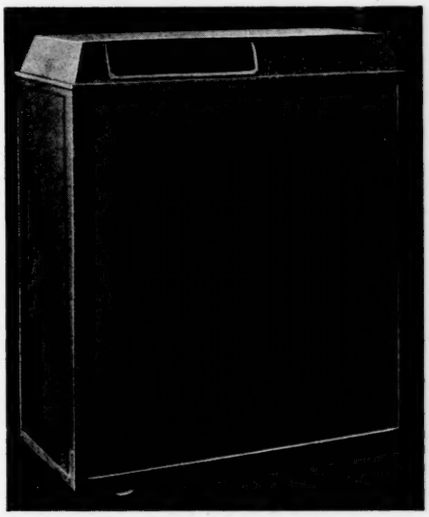
According to the manufacturer the device will maintain a relative humidity of over 40% at 70° in a space of 5000 cu. ft. Current consumption is low, being but 14 watts at maximum output.

Gauge Uses Tobacco Smoke To Register Draft

E. Vernon Hill Co., 121 North Clark St., Chicago, is marketing the Teltru smoke tube draft gauge in which the differential of pressure is indicated by tobacco smoke from the operator's cigar or cigarette. When the tube has been filled with smoke through the plug in the bottom, the intake nozzle is closed by the thumb or forefinger and the static tube inserted wherever a reading is desired. Air drawn through the intake nozzle forms a meniscus, or dividing line, between the smoke and the clear air, and the instrument is calibrated to indicate the desired draft by the location of this meniscus. For positive pressures, the instrument may be reversed.

Ice Room Cooler

Komforte Koolaire Co., Inc., 6144 Plankinton Building, Milwaukee, Wis., is manufacturing the Bright Komforte Koolaire cabinet type



Bright comfort cooler

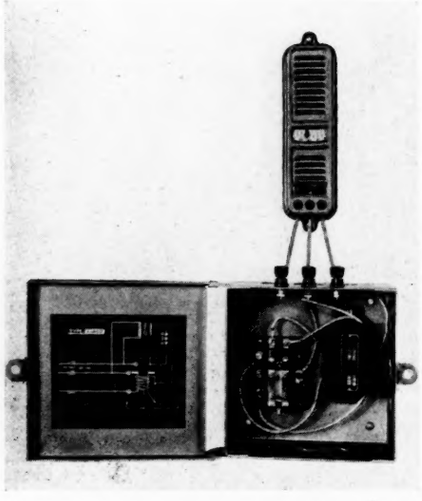
room cooler, using ice as refrigerant.

Ice is charged into an inner metal container having a capacity of 300 lb. Air is drawn in from the floor level by a motor-driven duplex blower and passes upward around the ice chamber, in contact with its chilled metal walls. At the top of the cabinet, the air traverses a series of cooling fins and is then passed directly over the top of the ice before being discharged, cooled and dehumidified, from the grille in the top of the unit. Both condensation and melted ice drain through a common connection. The cooler is mounted on 5-in. rubber tired castors for portability.

These coolers are said by the manufacturer to circulate 1000 cu. ft. of air per minute, and to have sufficient capacity to maintain comfortable conditions in a room of 3000 cu. ft. of space. One charge of 300 lb. of ice is melted in a run of 8 hr. to 10 hr.

Complete Control Assemblies for Air Conditioning Units

Julien P. Friez & Sons, Inc., Baltimore St. and Central Ave., Baltimore, Md., is manufacturing complete control assemblies for air conditioning applications. These consist of a Friez humidistat or thermostat together with a suitable holding circuit type relay, transformer, etc., mounted in an attractively finished knock-out type box with all wiring connections made. Controls are available in a number of standard models, with thermostat or humidistat mounted on the box or mounted separately for remote control, and for loads as high as 30 amp. at 110 volts. A three-way hand switch for manual control may be included if desired.

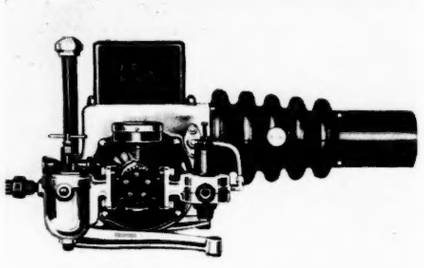


Friez humidity control assembly

A relative humidity indicator has also been placed on the market by the same manufacturer. Human hair, carefully treated, is used for the hygroscopic element, and readings are constantly indicated by a pointer on an easily read dial. A thermometer is mounted on the attractively finished case.

Century Announces New Burner

An improved automatic oil burner, designated Model 1DS, Century Supreme, incorporating several innovations in design, has been announced by the Century Engineering Co., Cedar Rapids, Iowa. It has a capacity of 1 gal. to 6 gal. per hr., and is suitable for large homes and small commercial applications, as well as for average residences.



Century Model 1DS oil burner

A silencing manifold reduces combustion and ignition noises in a series of expansion areas. Vibration is minimized by supporting the entire burner on a rubber bearing or sleeve in the clamp of the burner leg. This sleeve also permits adjustment of the height of the burner. A filter cartridge is installed in a housing designed to permit cleaning of the strainer by turning an external handle. Chromium plate and blue, black, green, or red enamel are used for finish. The blower manifold housing is made of brass because of its corrosion resistance and adaptability to chromium plate.

Link-Belt Builds Stoker

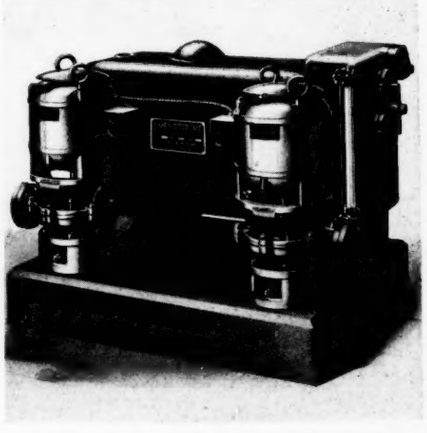
Link-Belt Co., 910 South Michigan Ave., Chicago, has announced production of the Link-Belt automatic underfeed screw stoker, an outgrowth of the variable speed stoker transmission manufactured for a number of years by this company. The stoker is made in a series of sizes suitable for heating plants and small power installations having boiler capacities ranging from 10 hp. to 250 hp.

Coal is propelled into the retort by a chrome steel screw conveyor, motor-driven through a variable speed transmission, providing for regulation of coal feed. A safety shearing pin protects the mechanism from damage in case of excessively hard foreign material finding its way into the coal. The forced draft fan is direct-connected to the motor, which is mounted so as to give an easily accessible and compact assembly. Automatic electric control regulates the operation of the stoker to maintain a predetermined boiler pressure.

Condensation Pump and Motor Mounted Vertically

Ames Pump Co., Inc., 30 Church St., New York, is manufacturing the Type G vertical condensation pump and receiver unit in a series of single and duplex models to meet a wide range of heating requirements.

Pump and motor are mounted vertically, forming a single unit, eliminating the possibility of misalignment of bearings, and removing the danger of damage to the motor in the event the cellar becomes



Ames duplex vertical condensation pump

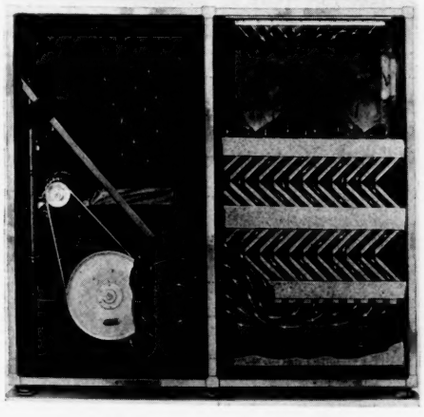
flooded. The pump casing, volute in form and of cast iron, is arranged with a bell-shaped suction inlet, mating with a similarly shaped opening in the base, providing a smooth passage and reduced velocity of flow to the inlet of the impeller. The impeller, cast in bronze, is of the single suction enclosed type. It is balanced hydraulically and dynamically and revolves freely within large clearances.

Receiver and base are cast integrally. Before entering the receiver, returns pass into a mud pocket and through a strainer, and an automatic safety device prevents operation of unit if strainer is not in place. The pump is equipped with a float switch, and suitable starting equipment is furnished when power conditions require it. Eleven sizes are available, ranging in capacity from 2000 sq. ft. to 100,000 sq. ft. of equivalent direct steam radiation, and the seven larger sizes are manufactured in duplex models, extending the capacity range accordingly.

Central Air Conditioning System for Steam Plants

Air Conditioning Equipment Corporation, Milwaukee, Wis., is manufacturing an indirect air conditioning unit for basement installation, designated the Climastat, Series AC. It includes positive temperature control, humidity control, washing and circulating, and may be connected with any standard refrigerator unit for cooling and dehumidifying the air during the summer months.

Blower is motor-driven through a texrope drive. The unit may be attached to any steam boiler or to a district steam line, and is adaptable to gas, oil, or stoker-firing. Air is delivered to the living quarters through circulating ducts. Available in two sizes having hourly outputs of 81,000 B.t.u. and 300,000 B.t.u. at 900 c.f.m. and 3200 c.f.m., respectively.

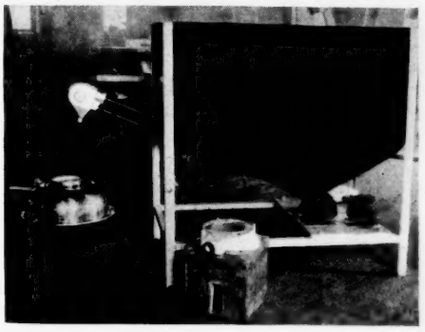


Sectional view of Climastat

Pulverized Fuel System for Residential Heating

Powderco, Inc., research subsidiary of National Fuel Co., Colorado Building, Denver, Colo., has developed the Powderco Thermator, a unit coal pulverizer system applicable to domestic furnaces and boilers. It is designed to prepare and burn economically the cheaper grades of coal to provide fully controlled automatic heat.

Coal is received from the hopper



Powderco unit, with grinding mill at lower left, and burner block in center foreground

and ground by an attritional process in the unit pulverizer to uniform fineness, whereupon it is delivered to the burner by an integrally contained fan. Ignition is started by a high tension spark. Operation is controlled by a pressurestat, or a thermostat which switches it into or out of service, the feed to the machine being constant for any installation. It is planned that coal will be delivered in sealed containers and deposited in the hopper by the coal merchant, who will also be responsible for removal of ashes.

Rotating Commutator Used in Electric Contact Control

Contact type electric controllers for regulating temperature, pressure, humidity, fluid flow, or liquid level have been announced by The Foxboro Co., Foxboro, Mass. Rotating commutator-type contacts are used, and the instrument has been named the Rotax.

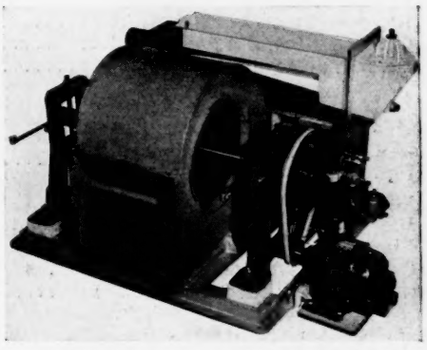
Increased accuracy of control, positive contact at all times, and a minimum of arcing are claimed for it by the manufacturer. Contacts carry only the relay load, and a simple, positive lockup type of relay can be used.

Conditioning Unit with Controlled Humidifier

A central air conditioning unit for the home has been announced by The Columbus Humidifier Co., 154 North Fifth St., Columbus, Ohio. The apparatus is for use with a warm-air plant or in connection with a steam or hot water system to provide forced circulation of filtered and properly humidified air.

An evaporator pan in which a constant level of water is automatically maintained is arranged over a humidistat-controlled gas flame. When the humidity in the living rooms falls below that called for by the humidistat setting, the gas burner is started by automatic ignition, and the same control causes the blower to start delivering the air to the rooms. When the desired humidity has been reached, the gas burner and blower are shut down. If gas is not available, an electric heating coil can be used for evaporation. The blower will also circulate warmed and filtered air under control of a furnacestat.

Gas burner is ignited by a safety pilot and controlled by a snap action valve. Four 16 in. × 25 in. Owens-Illinois glass-wool filters are installed in a sliding drawer for convenient inspection.



Columbus air conditioner, cover removed

Present Heating Season Continues to be More Severe than Last Year

January, 1933

DEGREE day totals for the 1932-33 heating season up to February 1 indicate a higher fuel consumption than was the case last year. As shown here last month, the whole country, with the exception of the west coast states, is experiencing a colder winter than the season of 1931-32.

The greatest increases are shown in the figures for New Orleans, Louisville, Memphis, Birmingham and Atlanta. Among the northern cities showing a considerably colder winter compared with last year are Philadelphia, Chicago, St. Louis, Cincinnati, Detroit and Indianapolis. New York is running 22.1% above last year, while Chicago figures show a 31.1% rise.

As compared with "normal" (fifty-year averages), however, only five of the cities reported below are having a relatively cold winter. These cities are Denver, Des Moines, Memphis, New Orleans and San Francisco. Cincinnati and Minneapolis are slightly warmer than normal, while the remaining 17 cities are all appreciably warmer than normal. The tendency of the degree day totals to show up higher this year than last, but at the same time amount to less than normal, indicates to some extent that we are going through that part of the weather cycle which will carry us toward winters colder than normal.

The cold wave which swept the country during February may be expected to add to this season's totals more than would normally be expected.

Degree day figures for January, together with cumulative totals for the present season, last season and normal are shown below, as are the unit fuel consumption data for the month of January.

(Percentages below indicate increase or decrease in degree days this year compared with last)

EAST	
New York	+ 22.1%
Philadelphia	+ 31.2
Boston	+ 9.5
Buffalo	+ 23.0
Baltimore	+ 39.4
Pittsburgh	+ 28.9
MIDDLE WEST	
Chicago	+ 31.1%
St. Louis	+ 37.4
Kansas City	+ 25.0
Minneapolis	+ 24.9
Cincinnati	+ 36.2
Cleveland	+ 19.6
Detroit	+ 30.6
Indianapolis	+ 37.6
Louisville	+ 68.6
Des Moines	+ 23.1
SOUTH	
New Orleans	+ 111%
Atlanta	+ 47.6
Birmingham	+ 55.7
Memphis	+ 52.5
FAR WEST	
Denver	+ 4.1%
Seattle	— 6.4
San Francisco	— 17.7
Los Angeles	— 24.0

Degree Days and Unit Fuel Consumption — January, 1933

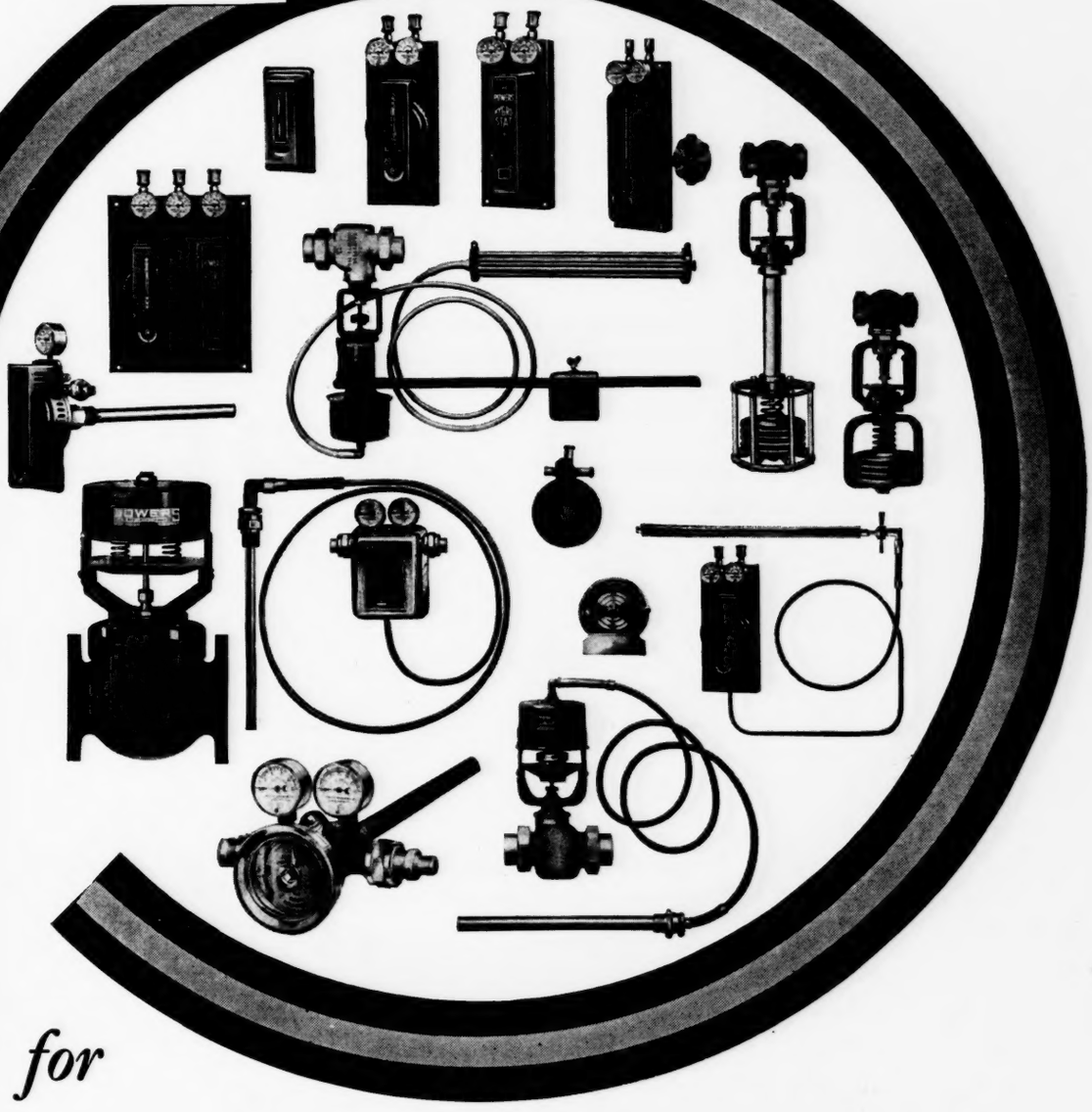
	Atlanta	Baltimore	Birmingham	Boston	Buffalo	Chicago	Cincinnati	Cleveland
Degree days for Jan. 1933	460	669	409	841	940	878	757	833
Degree days, Sept. 1, 1932 to Jan. 31, 1933	1668	2222	1489	2694	3261	3307	2771	2918
Degree days, Sept. 1, 1931 to Jan. 31, 1932	1130	1594	956	2460	2651	2515	2036	2441
Degree days, Sept. 1 to Jan. 31, Normal	1813	2619	1502	3280	3611	3487	2795	3365
Lb. coal/sq. ft. rad., Jan. 1933	3.680	5.352	3.272	6.728	7.520	7.024	6.056	6.664
Gal. oil/sq. ft. rad., Jan. 1933	0.315	0.459	0.280	0.577	0.645	0.602	0.519	0.571
Cu. ft. gas/sq. ft. rad., Jan. 1933	44.16	64.22	39.26	80.74	90.24	84.29	72.67	79.97

	Denver	Des Moines	Detroit	Indianapolis	Kansas City	Los Angeles	Louisville	Memphis
Degree days for Jan. 1933	896	956	961	799	701	333	677	462
Degree days, Sept. 1, 1932 to Jan. 31, 1933	3413	3777	3353	3014	2887	691	2490	1890
Degree days, Sept. 1, 1931 to Jan. 31, 1932	3279	3044	2566	2191	2310	909	1773	1240
Degree days, Sept. 1 to Jan. 31, Normal	3355	3762	3585	3130	3229	750	2526	1871
Lb. coal/sq. ft. rad., Jan. 1933	7.168	7.648	7.688	6.392	5.608	2.664	5.416	3 696
Gal. oil/sq. ft. rad., Jan. 1933	0.614	0.656	0.659	0.548	0.481	0.228	0.464	0.317
Cu. ft. gas/sq. ft. rad., Jan. 1933	86.02	91.78	92.26	76.70	67.30	31.97	64.99	44.35

	Minneapolis	New Orleans	New York	Philadelphia	Pittsburgh	St. Louis	San Francisco	Seattle
Degree days for Jan. 1933	1295	187	770	689	809	665	558	784
Degree days, Sept. 1, 1932 to Jan. 31, 1933	4534	736	2503	2245	2804	2617	1454	2563
Degree days, Sept. 1, 1931 to Jan. 31, 1932	3631	349	2049	1711	2176	1904	1766	2739
Degree days, Sept. 1 to Jan. 31, Normal	4550	735	2910	2734	3003	2798	1414	2656
Lb. coal/sq. ft. rad., Jan. 1933	10.360	1.496	6.160	5.512	6.472	5.320	4.464	6.272
Gal. oil/sq. ft. rad., Jan. 1933	0.888	0.128	0.528	0.472	0 555	0.456	0.383	0.538
Cu. ft. gas/sq. ft. rad., Jan. 1933	124.32	17.95	73.92	66.14	77.66	63.84	53.57	75.26

Fuel consumption figures given above are based on certain conditions, and for other conditions corrections must be made. The figures assume the use of steam radiators emitting 240 B.t.u. per sq. ft. per hr., a system operating at 100% efficiency, and radiators calculated for maintaining 70° in zero weather. Heating values assumed for the fuels are 12,000 B.t.u. per lb. for coal, 1000 B.t.u. per cu. ft. for gas, and 140,000 B.t.u. per gal. for oil. To correct for other heating values, efficiencies, and design conditions, follow the method explained in the "Heating and Ventilating Degree Day Handbook."

Accurate Dependable Control



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THERMOSTATS—both graduated and positive acting for dry bulb control. **Hygrostats**—both pneumatic and electric for humidity control. **Self Contained Regulators**—complete line for control of air and liquid temperatures. **Brine Control**—regulators for control of brine circulating systems. **Dampers**—both single and multiple blade, with or without operating diaphragm motors. **Diaphragm Valves**—All metal construction, including three-way valves, brine control valves, etc., etc. **Accessories**—Automatic Water Pan for wet bulb control, Relays, Pressure Reducing Valves, Pneumatic Switches, Dial Thermometers, etc., etc. ***Write for Bulletin No. 251,*** which describes these Instruments.

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Offices in 43 Cities—**Chicago, 2718 Greenview Ave.; New York, 231 E. 46th St.; Toronto, 106 Lombard St.**

OWERS

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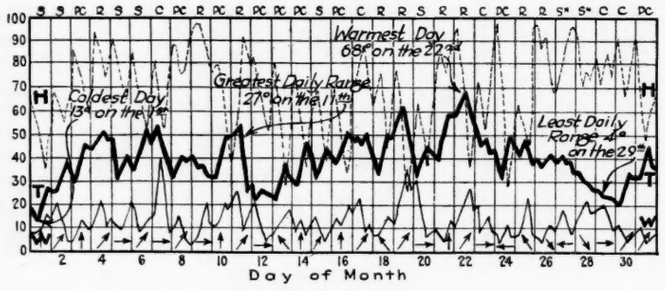
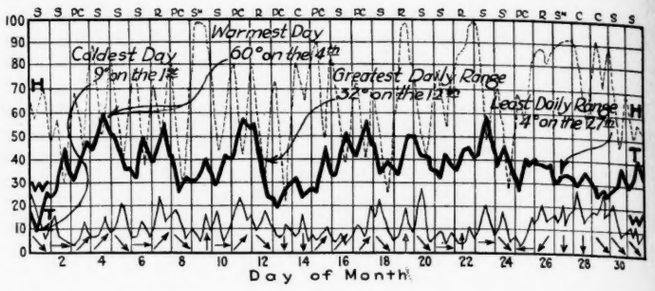
The Weather

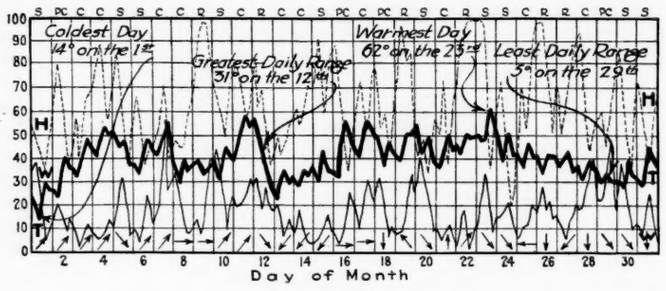
January, 1933



Pittsburgh

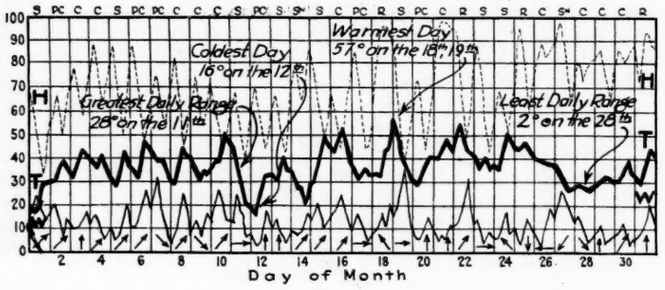


Boston

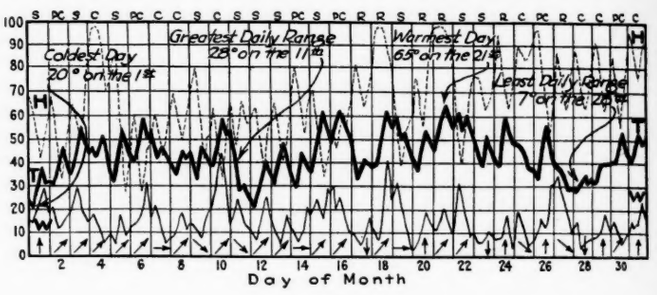


New York

(Hourly observation of the Relative Humidity Plotted on this Chart)



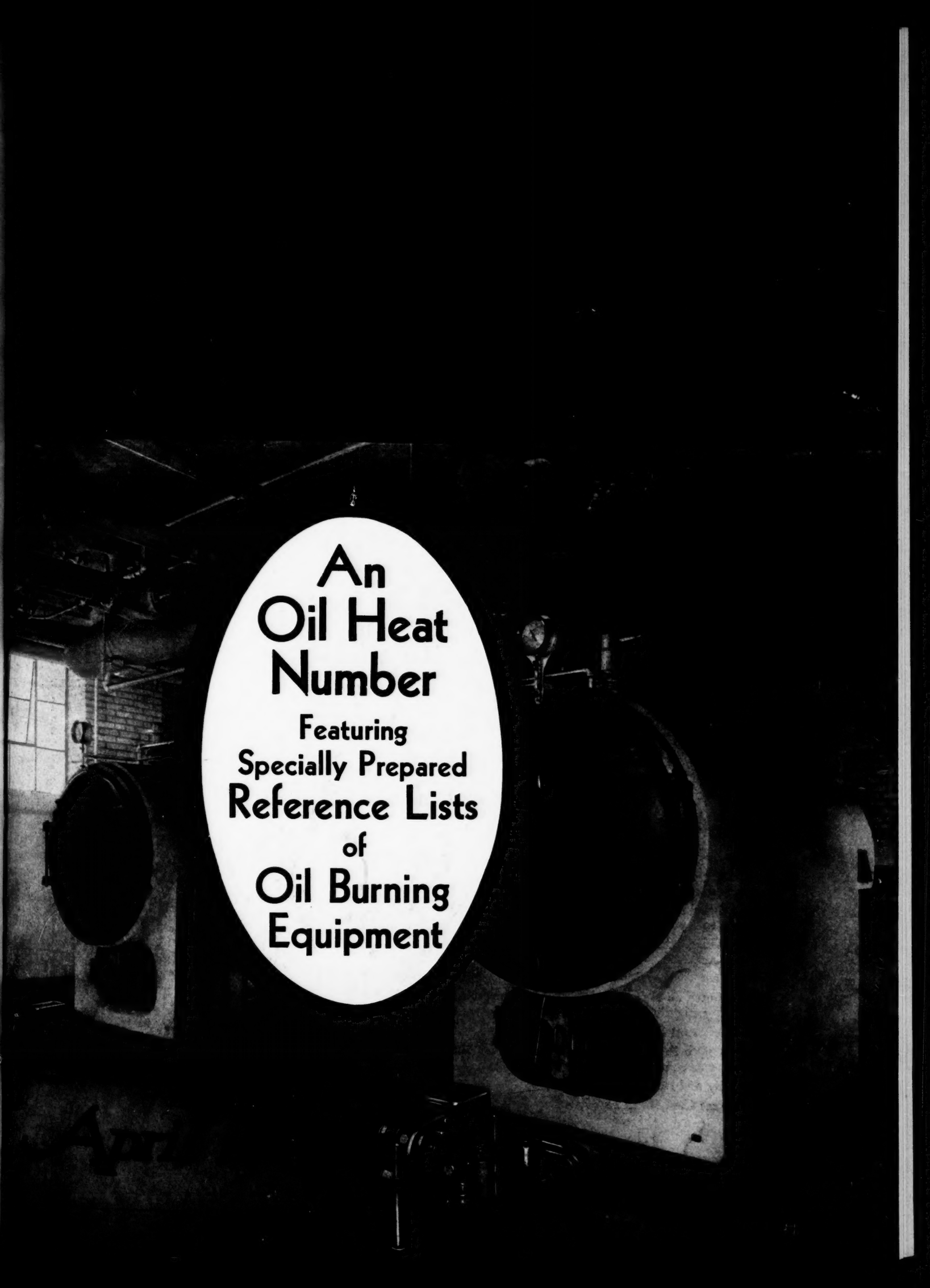
Chicago



St. Louis

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F.	62	60	68	57	65
Date of highest temperature	23	4	22	18–19	21
Lowest temperature, deg. F.	14	9	13	16	20
Date of lowest temperature	1	1	1	12	1
Greatest daily range, deg. F.	31	32	27	28	28
Date of greatest daily range	12	12	11	11	11
Least daily range, deg. F.	5	4	4	2	7
Date of least daily range	29	27	29	28	28
Mean temperature for month, deg. F.	40.2	37.8	39.0	36.7	43.6
Normal mean temperature for month, deg. F.	30.9	27.9	30.7	23.7	31.1
Total precipitation, this month, inches	1.53	2.04	2.39	2.32	2.18
Total snowfall, this month, inches	Trace	1.3	0.3	0.9	Trace
Normal precipitation, this month, inches	3 66	3.61	3.05	1.90	2.34
Total wind movement, this month, miles	11,773	7,785	8,570	9,143	10,573
Average hourly wind velocity, miles	15.8	10.5	11.5	12.3	14.2
Prevailing direction of wind	N.W.	N.W.	S.W.	S.W.	S.W.
Number of clear days	10	10	5	8	11
Number of partly cloudy days	5	10	10	6	10
Number of cloudy days	16	11	16	17	10
Number of days with precipitation	7	8	10	7	9
Number of days with snowfall	2	4	2	2	None
Snow on ground, at end of month	None	None	None	None	None

Plotted from records especially compiled for HEATING AND VENTILATING by the United States Weather Bureau.
Heavy lines indicate temperatures in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 a.m., 12 m., and 8 p.m.
S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow. Arrows fly with prevailing directions of wind.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